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Original Correspondence.

THE LINK MOTION AS APPLIED TO LOCOMOTIVE AND WINDING ENGINES.

At the South Yorkshire Association of Foremen in the Coal and Iron Trades meeting, at Barnsley, on Saturday, a very interesting paper "On the Link Motion, and the Expansive Working of Steam," &c., prepared by Mr. R. Fawcett, formerly of Penistone, but now manager of the locomotive works of the London, Chatham, and Dover Railway Company, was read by the secretary. After some prefatory remarks, the writer proceeded to say that the link motion was an entirely expansive one, and the first time that steam had been used expansively was about the year 1781, by Jonathan Hornblower, who took out a patent in that year for an ingenious method of employing steam to act expansively. From some cause or other, however, Hornblower's engine did not come into general use, but in the following year Watt took out a patent for an expansive engine. That, then, might be taken as the commencement of employing steam so as to work expansively, for the action was effected by admitting high pressure steam at the beginning of the stroke of the piston; but, cutting it off after it had moved a certain space, he allowed it to expand to the end of the stroke. Coming down to the year 1804, they found one Arthur Woolf projecting a new form of expansive engine, from which great things were expected, and who supposed he had dissovered the existence of a new law in the expansion of steam. The supposed discovery was simply that if steam generated at 50 lbs. above the pressure of the atmosphere was allowed to escape into a large vessel of the same temperature, it would expand to 50 times its bulk. In that, however, he was wrong, for the expansion would be inversely as the pressure, for a cubic foot of steam generated at 50 lbs. above the atmospheric pressure would (reckoning the atmospheric pressure at 15 lbs. per square inch) expand in the proportion of 15 to 15 plus 50, or 15 to 65, which is 1 to 4½, or, to make it still plainer, a cubic foot of steam at 50 lbs. pressure when expanded would only occupy 4½ cubic feet instead of 50, according to Woolfe's theory.

From the last-named date they would find that every maker of an engine invented some ingenious modification, which, if it did not end in improvement, was at least a change, and no doubt tended to some extent to keep up the chase for a more perfect form of valve motion. They, however, did not come to any very progressive results until about the year 1834, when they found Pambour making numerous experiments on the Manchester and Liverpool line of railway, by giving the valve what is called in workshop phraseology "lead" and "lap," but only to a limited extent. After that Mr. Lawrence took the next progressive step, by increasing not only the outside lap but also the travel of the valve, thus ensuring almost perfect freedom of exhaust. Up to that time there was no control over the distribution of the steam so as meet the exigencies of the load, curves, inclines, &c. The "regulation," as it was and is still called, being the sole means at the command of the driver for such purposes, and like all other hand work, doing it very irregularly. To Mr. John Gray has been awarded the honour of inventing and bringing into practice the piece of mechanism which has gradually ripened into the link motion of the present day. Although Gray's invention was somewhat cumbrous and complicated, and did not come up to the inventor's anticipations, yet the germ of success was there, and they found it gradually developing, until, in the hands of Stephenson, it became almost what it was at the present time.

Having, then, traced the progress made in the working of steam expansively from the earliest date, the next thing was to explain the various forms of link motions now in use, and the mode of working. For better illustration, they would be divided into three classes—the stationary link, in which the varying motion of the valve was effected by moving the sliding block up or down in the link, which remains immovable on the shaft (as seen in the sketch before them) with only one eccentric. Secondly, the shifting link, in which the link moves up and down the sliding block, which remains stationary. The third form was that called the straight link motion, by which the link and sliding block both moved simultaneously in opposite directions, thus effecting all that the curved link could accomplish. No piece of mechanism had met with so many varieties and differences of opinion amongst engineers as the link motion, nearly everyone varying in opinion as to the amount of "lead," lap, travel, &c., of the valve it works, and the experiments which have been, and are daily being made are numberless, but all aiming at one end—that of arriving at a satisfactory expansive working of steam, and the reduction of the amount of material consumed in raising it. The first form of motion, as classed, was not by any means common. He (the writer) had had great facilities for watching and noting its working, and although it worked very well, and had only one eccentric instead of two, it did not appear to make that progress towards becoming general which its working would warrant. In fact, he believed that in some instances it had been discarded, and replaced by the old, or second form of motion. That might be attributable to the extra strength it had to be made, and the great weight and strain it threw on the crank shaft, thus increasing the wear and tear, &c. The second form of motion was the one mostly in vogue for locomotives at present, it being found to work very satisfactorily, and at the same time being very simple in comparison with the first form. Its working they would be well acquainted with. The third form of motion was of comparatively recent date, and was the invention of Mr. A. Allan, late of the Scottish Central Railway, and from what it has achieved bids fair to become the link motion most applicable to the locomotive. That motion differed very materially from the other two in having a straight instead of a curved link, the latter being compensated for by a judicious arrangement of levers. There were, however, more important claims to be put forward than that just named, as by one part of the motion counterbalancing the other that ugly monstrosity—the balance weight—could be dispensed with. That in itself was no insignificant claim, but there remained one more important than even that—the perfect ease with which it could be reversed either under ordinary circumstances to suit the variations of the road, or in the moment of danger with the steam full on the valves. Another advantage which the motion possessed was the great economy of space, admitting of the boiler being lowered, and with it the centre of gravity. That, also, must be taken as a step in the right direction, as it would reduce the oscillation when running at high speed, and also the danger to a certain extent. There were other claims also in favour of the motion, such as a decrease of the tortional strain on the reversing shafts, a decrease in the angle of the eccentric rods, &c., which, no doubt, will all be proved with time to be practically valid in affecting the prime cost of construction, and wear and tear in working.

There were other forms of link motion, but they would all come under the classes he had noticed, there being many modifications by different engineers. With regard to the practical working of the link, it gave a perfectly easy reversible motion, by which the engine may be moved either forwards or backwards, at will. By a notched quadrant and catch to the travelling lever it may be held in any position whilst working. The nearer the sliding block is worked to the centre of the link the less the travel of the valve, and the nearer the sliding block is worked to the ends of the link the greater the travel. The driver was thus enabled to regulate his engine to the load, inclines, curves, &c., and gave himself a perfect command over the distribution of the steam, and so effecting a saving in fuel. Another, and no less important, use of the link motion was the perfect control it gave to the driver over his engine, so that he could check the forward velocity of his load in cases of danger, if seen in time. To work steam expansively it was not necessary to have the link motion, as any engine could be made to do without it; but in the locomotive engine it was simply indispensable, for by it the engines were reversed, and made to work either backward or forward at pleasure, whilst the regulator was at the command of the driver, who was able by it to set the valve to any travel, according to circumstances. It was easy to see the relative amount of the admission, expansion, compression in proper percentages of the stroke, the amount of steam admitted to the cylinder during one stroke of the piston, the point at which the steam is cut off and where the expansion begins, with the amount of compression, &c, By means of a diagram all those matters could be seen at a glance, and the principal points in connection with the distribution of the steam by the slide valve and link motion. He had tried to make those essentials in connection with the link motion as applied to engines and the expansive working of steam as plain as possible, and had avoided as far as he could all difficult arithmetical problems and calculations which had been worked out by experienced engineers, and he had no doubt but many of those who had heard the paper read would find it useful and satisfactory at some time or other for them, by means of a pencil and paper, to know that they were working their engines to the best advantage or otherwise; and with a little practice, and with the aid of such a simple diagram as that he had prepared, they would find it no difficult matter to alter any engine for the better which was not working as well as it ought and was intended to do. In conclusion, the writer said if the paper on such an exhaustless subject had contributed even a little to their previous knowledge he should feel amply repaid and gratified.

It was unanimously agreed that a cordial vote of thanks should be tendered to Mr. Fawcett for his very able and interesting paper, on a subject so important to the members of the association.

COLLIERIES IN NORTH DURHAM, THEIR WORKINGS AND MACHINERY—No. XVII.

COCKEN, BRASSIDE, AND FRANKLAND COLLIERIES.

These collieries (in continuation of last article) form the remainder of the Earl of Durham's collieries we have to notice. The area of mineral property attached to Cocken Colliery, which includes Cocken and Finchale estates, is 700 acres (Cocken adjoining Lumley estate on the south). South-west from these, on the opposite side of the River Wear, to Cocken, are Brasside and Frankland properties, in area 650 acres.

The only seams of coal yet discovered at the three collieries are the Low Main and Hutton seams, excepting a limited area of Main coal on Cocken estate, which has been worked from several pits by the old miners. The Low Main seam has also been worked to some extent by old miners in the neighbourhood of Frankland, by adits from the level of the Wear, for drainage, and by shallow pits for raising coal. The seam varies in thickness from 9 in. to 2 ft. 10 in. The pillars are found 3 yards in breadth, the bords the same; several specimens of miners' shovels, picks, mauls, and wedges, and wooden rails have been found in these workings, which are supposed to have been used over 100 years ago.

When the Earl of Durham became lessee of these properties the Hutton seam was intact; this seam has yielded supplies of excellent coal for considerable periods, and has now nearly reached the state of exhaustion.

On the western side of the Cocken, Finchale, Brasside, and Frankland properties, a remarkable deposit of drift occurs, usually termed the "wash," denuding both Low Main and Hutton seams, and curtailing the area of coal stratum in each property to a slight extent. The Frankland Pits being sunk through the drift on its eastern margin, and Framwellgate Moor Pit on the western margin, the distance between them of 2550 yards gives nearly the extreme breadth of the deposit; but as it has a considerable slope on each side in passing downwards, the breadth of Low Main coal denuded is supposed to be 2200 yards, and of the Hutton seam 1580 yards. The workings of the Hutton seam at these collieries have at many points been driven into the drift; the bed of coal at the edge is found to be grooved and furrowed in a remarkable manner, as if worn by the action of strong currents of water. The drift itself, in proximity to the bed of coal, consists of water-worn boulders of limestone, millstone grit, and the coal measures; some of these are of large size, and intermixed with sand and clay, but water is not often given off when the drift is driven into.

The wash has the apppearance of having at one time formed the bed of a mighty river. Commencing at the mouth of the River Team, one mile above Newcastle, the bottom of the drift is found there 158 ft. in depth from the surface, and 140 ft. below high-water mark of the sea, notifying that a great change has taken place in the relative levels of the land and sea since its existence as a river. The drift formation continues from the Tyne by Birtley, Lumley, and Frankland to the city of Durham, in a nearly straight line, and at a regular rise in its bed, a distance of 14 miles, from whence it is observed to branch off in two directions—one to the south, and another westward, to a great extent. Between the River Tyne and Durham the Hutton seam is more or less denuded by the drift, excepting that portion lying between Harbour House and Birtley, which is unaffected by it, the workings of the Hutton seam in the second pit, Lumley, having passed under the drift into Chester property. The course of the River Wear between Durham and Chester does not at all correspond with the direction of the ancient river; the former pursues a winding course. At Frankland viaduct the sandstone and shale of the coal measures have been worn away from its action to a depth of 90 ft., and this channel seems to have been formed in preference to cutting one through the drift. The lowest part of the bed of drift is found generally to be about 90 ft. below the bed of the present river, between Durham and Chester, and at the latter point the Wear diverges off to the sea at Sunderland. As regards the Harvey seam in Finchale, Brasside, and Frankland properties, it is probably not affected by the drift, even where its bed reaches the greatest depression.

Cocken Colliery was opened in the Hutton seam in 1823, which is now exhausted. The downcast pit is 10½ ft. in diameter, 46 fms. in depth to the Hutton seam, divided into two sections by plank brattice, 4½ ft. of this being used for the pump work; the other section is the coal pit. The upcast pit in Finchale estate, 800 yards to the west, is now abandoned. An upcast pit 10 ft. in diameter has recently been sunk to the Low Main seam, 22 yards distant from the downcast: this seam is now being worked. The following seams are found at Cocken pit:—

	Thickness.	Depth.
1.—Main coal seam—Coal	2 ft. 6 in.	18½ fms.
2.—Low main seam—Coal (household second-class)	3 0	31½ "
3.—Hutton seam—Good coal	4 ft. 2 in.	
Coarse ditto	0 7 = 4 9	46½ "
In Finchale—Coal	3 10	
Coarse	0 7 = 4 5	

The winding-engine—erected here in 1823, and had been in use previously—has an open-topped cylinder with separate condenser, and is, we believe, the only one of its kind in the northern collieries; cylinder 36 in. diameter, 5-ft. stroke, 12 lbs. steam pressure used under the piston. The pressure above the piston, obtained by the partial vacuum in the condenser, is from 11 to 12 lbs. per inch; the steam and atmospheric pressures are thus nearly equalised. As its greatest speed the engine goes at the rate of 20 strokes per minute, with two flat hemp rope winding-drums, 7 ft. in diameter. About 160 tons of Low Main coal is raised per day with single-tub cages. For many years it has raised 400 tons per day from the Hutton seam. One plain boiler, 27 ft. by 6 ft. 3 in., fired at end, supplies steam at 12 lbs. pressure. The pumping-engine—erected here new in 1822—is an atmospheric beam-engine, with separate condenser and air-pump, open-topped cylinder, 50 in. diameter, 6-ft. stroke; pressure of steam used under the piston, merely to form a vacuum, is 4 lbs. The engine has two valves, worked by an air cataract. Water is raised in two lifts, both in the pit, from the depth of 48 fms. The lower lift 19 fms., 14 in. bucket; top lift 29 fms., 15 in. bucket, 6 ft. stroke. A little balance weight is placed at the back end of the beam. The speed of the engine varies with the seasons, from 4 to 8 strokes per minute; at present the rate is 6½ strokes per minute, day and night. Calculated at 45 gallons per stroke, this gives 292 gallons per minute. The load in the pit, water, rods, buckets, &c., is raised nearly altogether by the partially formed vacuum under the piston, equal about 11 lbs. below atmospheric pressure, representing a force of 21,598 lbs. on the top of the piston, and 31-horse power at its maximum speed. Two haystack boilers supplied steam until lately. Three boilers have been erected, 33 ft. by 3 ft. 6 in., flash-flued, fired at end and side; these are intended to supply both engines. The heapstead and framing, four screens, and inclined elevator are all of wood. Main and tail-crabs and jack-gin are erected for pump work.

Brasside Colliery.—Coal work commenced here in 1846. One coal pit and downcast, 10 ft. in diameter, is sunk 33 fathoms to the Hutton seam. The upcast pit, 22 yards distant, is 6 ft. in diameter. A pit for the pumps, 9 ft. in diameter, is put down near the upcast. The Low Main seam is found here 18 in. in thickness at 21 fathoms. The Hutton seam includes—Good coal, 4 ft.; coarse, 6 in.=4 ft. 6 in. The winding-engine has a 28½-in. cylinder, 5½-ft. stroke, cast-iron levers, two 7 ft. 2 in. flat wire-rope drums, 20-ft. fly-wheel; these rest on side wall and wood framework. Steam supplied from two plain boilers at 25 lbs. pressure—one, 30 by 6 ft., fired at end and side; one, 24 by 6 ft., fired at end only. About 180 tons of Hutton seam raised per day in single-tub cages. The pumping-engine has one 29-in. horizontal cylinder, 6-ft. stroke, 3-ton fly-wheel on main shaft. From a disc at the end of this shaft a horizontal rod works back direct to two quadrants fixed over the pumping pit. Water is raised by a double column of pumps from the depth of 34 fms. to an adit 12 fms. below the surface=22 fms., with 18-in. buckets, 4-ft. stroke, each column discharging alternately to the adit. The engine goes at nights only, at the rate of nine strokes per minute. At 88 gallons per stroke the discharge of water will be 792 gallons per minute. A 9-in. bucket-lift raises water from the adit to the surface; the suction pipes are laid along the adit to the bed of the river, a length of 330 ft., and 21 ft. in vertical depth; this water is raised specially to feed the boilers, that obtained from the pit is unfit for that purpose. One pump only is worked in the mine by a pony, being double-acting, 6-in. plunger, 18-in. stroke. The heapstead and framing, four screens and inclined elevator erected here are all of wood; the whole of this plant was renewed eight years ago. There are also one main crab and jack gin for pump work.

Frankland Colliery.—Coal work commenced here in 1842. Two pits are sunk to the Hutton seam, 22 yards apart, 30 fms. in depth. The coal pit and downcast is 12 ft. in diameter; the upcast, with chimney over it, is 7 ft. in diameter. The Low Main is found here 2 ft. in thickness, at 18 fms. The Hutton seam contains—good coal, 3 ft. 9 in.; coarse coal, 6 in.=4 ft. 3 in. The winding-engine has 29-in. cylinder, 5-ft. stroke, cast-iron levers; two 11-ft. flat wire-rope drums; 20-ft. fly-wheel. These are supported on side wall and an intermediate ashlar wall. Steam supplied from two plain boilers, at 25 lbs. pressure, one 34 by 5 ft., fired at end and side, one 24 by 6 ft., fired at end, for two engines. These boilers are roofed over. The fittings comprise two safety-valves, one common float, one float and whistle, and 4-in. sludge-valve to each. The boilers at the three collieries described are in each case fed by a pump attached to the winding-engine. The Hutton seam, at Frankland, is worked back to the pit, and is practically exhausted; the shaft-pillars only remain. A small quantity of coal is raised with single-tub cages. Of the three collieries this is the only one in which underground hauling has been adopted; the hauling-engine is placed at the surface, and as it is done with haulage in the mine it is now utilised for hauling wagons on the branch railway of ¾ mile, by main and tail ropes, to

the top of a self-acting incline. This engine has a beam resting on metal-framed pillar, 15-in. cylinder, 3 ft. 10 in. stroke, pinion 2 ft., spur-wheels 4 ft. 10 in.; two drums on separate shafts, 4 ft. 4 in. diameter, with slide carriages, and break to each drum and to the fly-wheel. The heapstead and framing, four screens, and inclined elevator, are all of wood. Small coal is washed here by appliances similar to those used at Sherburn Hill. An engine placed near the River Wear forces water up to the pit, 150 ft. of vertical height, through 7-in. pipes; this is used for feeding the boilers and for washing coal. The engine has one 14-in. horizontal cylinder, 2-ft. stroke, wheels in ratio of 1 to 2, working by back horizontal rod, and one quadrant a 10-in. vertical pump, 2½ ft. stroke.

UNDERGROUND WORKINGS AND VENTILATION.

Colliery.	Circulation. Cub. ft. p. min.	Furnace power.	Size of up-cast, ft.	Depth. fms.	Number of horses,	ponies.
Cocken	15,000	One—9 ft. by 6 ft.....	10	31	6	14
Brasside	25,000	One—9 ft. by 6 ft.....	6	33	6	13
Frankland....	10,000	One—9 ft. by 6 ft.....	7	30	0	4

Coal is got on the bord and pillar system. Pillars are made of the uniform size, 16 by 12 yards; bords, 4—walls, 2 yards wide. The cleavage is north and south at Brasside; at Frankland it changes to north-west and south-east. In the whole of the workings of these collieries lighting by candles is adopted; no lamps are used, and the production of inflammable gas is almost *nil*. The coal is conveyed from Brasside and Frankland Collieries by private lines. By a self-acting incline from each—still worked by round hemprope and 6-ft. plain horizontal wheel, the wagons are lowered to the Wear side, from whence they are drawn over a wooden viaduct, and up the opposite bank by a stationary beam-engine, with two drums under the road, three wagons ascending and descending together. From this the conveyance is by locomotive line, to join the main line from Sherburn Collieries. The coal is conveyed from Cocken Colliery by a separate line, forming a junction with Lambton Railway at Burnmoor. There are small workshops at each of these, and also at the Sherburn Collieries. The principal shops are at Littletown, consisting of joiners' shop, 50 ft. by 31 ft.; fitting shop, 60 ft. by 22½ ft., containing gap lathe, drilling machine, planing machine, punching and shearing machine, and a large self-acting circular saw-bench outside; these are driven by a horizontal engine of 15-in. cylinder, 18-in. stroke, and one plain boiler 20 ft. by 5 ft., fired with Juckes's bars. In addition to these there are smiths', saddlers', tinners', bucket and clack repairing shops, and storehouse. The whole of these have been built within the last six years, and the engineering work and repairs for this section of the collieries can all be executed here.

THE VENTILATING FAN AT USWORTH COLLIERY.

There was a large gathering to witness the experiments with this gigantic Fan on Friday last, and the results can only be considered as perfectly satisfactorily. It will be understood that this fan is on the Guibal principle, and it is the largest machine of the kind yet erected—the diameter of the fan being 45 ft., and the width 12 feet. A number of fans on the principle have been erected in this district, the smallest being about 20 ft., and experience has proved that they have not only been uniformly successful, but surpassed all others, both as to efficiency and economy. A number of other fans have been tried—the Lemielle machine, Rammell, Waddell, &c., but it is now pretty generally acknowledgd that the Guibal excels all these.

We now give a detailed account of the experiments made with this Fan on Friday, and the results arrived at. The dimensions are as follows:—The fan is 45 ft. in diameter, and 12 ft. wide; it has ten arms, and is provided with an outlet chimney and regulating shutter. It is driven by a pair of engines, placed diagonally, having cylinders 36 in. diameter each, and 3 ft. stroke, constructed by Messrs. Black, Hawthorn, and Co., Gateshead. With the engines working at 40 revolutions per minute, 150,000 cubic feet of air are calculated upon at a water-gauge of 2·8, and the minimum calculated upon with 60 revolutions is 240,000 cubic feet per minute At 10·45 the official experiment was made, under the direction of Mr. D. P. Morison, agent for the patentee, and gave the following results:—Engines 40 revolutions per minute; indicated horse-power of the engines, 114·62; volume of air, 147,000 cubic feet per minute; water-gauge, 2 8; water-gauge bottom of chimney, 0·75; horse-power on the air, 64·90; percentage of utilised power, 56·63. The experiment was considered highly satisfactory, and great admiration was expressed at the excellent workmanship and material, both of the engines and ventilator. Since the machine has been in operation the whole of the men and boys in the pit have felt an improvement in the air, and are able to follow their occupation in greater comfort. In all respects, therefore, the experiment is a success, and Mr. S. B. Coxon, the resident engineer, has reason to feel gratified that he has been able to promote the health and safety of the miners, at the same time that he has done well for the owners.

At the conclusion of the experiments Mr. Coxon entertained the gentlemen present, about 100 in number, to dinner at Usworth Hall. Amongst those present were—Messrs. George Elliot, M.P., J. Jonassohn, G. W. Elliot; Mr. James Easton, Gateshead; Mr. Alderman Hunter, Newcastle; Mr. Wm. Cochrane, Elswick; Mr. R. Matthews, South Hetton; Mr. A. S. Palmer, Wardley; Mr. Brown, Ryhope; Mr. W. Cockburn, Upleatham; Mr. Southern and Mr. Willis, Mine Inspectors; Mr. J. Daglish; Mr. Hawthorn; Mr. E. F. Boyd, President of the Mining Institute; Mr. C Berkeley, Marley Hill; Mr. S. C. Crone, Killingworth; Mr. John Peele, Springwell; Mr. A. Ross, Gateshead; Mr. Murray, Chester-le-Street; Mr. Moore and Mr. Hepplewhite, Hetton; Mr. G. May, North Hetton; Mr. Morison; Mr. Bailes, Newcastle, &c.

After the repast, the Chairman (Mr. S. B. Coxon) proposed the usual loyal and patriotic toasts, coupling "the Army" with the name of Major Palmer, of the Jarrow Engineers, and "the Bishop and Clergy," with the name of Mr. Thackray, both of whom responded. Mr. James Easton then proposed "Prosperity to Messrs. Geo. Elliot and J. Jonasshon," which was drunk with musical honours.

Mr. George Elliot, M.P., in responding, said he could endorse every word Mr. Easton had said as to the highly improved condition of the colliery, as compared with what it was in 1848. More recently they had been in difficulties, owing to the system of ventilation, which had nearly exhausted their resources—in fact, the colliery under the mode of conducting it was nearly at an end, and it became a question whether more pits should be sunk or the pits could be efficiently ventilated by any other system. He was impressed at a very early period with the idea that mechanical ventilation would entirely supersede the old system of furnace ventilation. This mode of ventilation enables us to take all furnaces and flues out of the pit. He was very much inclined to take a course which might not be approved by his brethren, and say that in dangerous mines they ought not to have any fire except what was necessary for light. He felt certain he would be condemned by a great many for advocating so strong a measure, but with the improved system of sending steam and air down the pit he had a strong conviction that it would be the most economical and safest way of working. Power might be applied, either hydraulic or otherwise, not only for transporting the produce of the men, but also in working the coal. If only safety-lamps could be used underground very many accidents might be avoided. He thought that public opinion was against the Legislature saying that furnaces should be removed, but he did not think that it would be injurious to the coalowner if it were stipulated that henceforth in all dangerous mines furnaces and steam-boilers should not be placed in pits. He thought that the present race of mining engineers were better, more highly educated, and more earnest in their work than old-fashioned gentlemen like Mr. Easton and himself, and would minimise the deaths from explosions. He felt certain that they were on the right road by taking all fire out of the pit, by getting rid of blasting with gunpowder as far as they could, and by ventilating with fans. The fan is a success, and has superseded the furnaces, being more efficient and economical, and he felt certain that from the owners' point of view they would not lose by getting rid of those dangerous furnaces and flues underground.

A very interesting discussion ensued on the points raised by Mr. Elliot, and the feeling of the meeting was against any legislative enactment rigidly defining the use or disuse of open lights and furnaces in mines; and various opinions were also expressed respecting the policy of erecting fans for ventilating very deep mines. It must be recollected that the furnace has been brought to great perfection in this district, and the adoption of the fan can only, and very properly, be brought about slowly, and with due caution. Even after the power of the fan was acknowledged, and it was conceded that it was more powerful and economical than the furnace, an objection still remained, which was considered by most practical pitmen to be fatal to its success, and that objection still has some weight, at any rate, in particular cases. It was objected that as the fan was the sole ventilating power, and this fan was driven by machinery liable to derangement, the current of air might cease at any moment, should an accident occur to the machinery. Practical experiments, however, have been made by Mr. Coxon, at Usworth, to determine this point; and it was found that when the fan was stopped a large amount of air still continued to circulate in the mine—about 40,000 cubic feet per minute, quite sufficient to prevent any immediate danger from this cause. This is, no doubt, due to what is termed "natural ventilation," caused by the natural heat of the mine, and it is most powerful in deep mines, and in *winter*, when the thermometer is lowest. In mines of a moderate depth this power is very trifling, and in a not summer is nothing, so that, although the economy of this fan, as compared with the furnaces, is greatest in mines of moderate depth, the objection we have just noticed has more weight in connection with these mines than it has in connection with mines of great depth, as the natural ventilation is there very powerful, although much less in *summer* than in *winter*. This objection has to a great extent been provided for in cases when only one engine is employed in driving the fan, as a duplicate engine is provided, which can be attached in a very few minutes in case of breakage.

It is impossible to inspect the machinery at Usworth Colliery without being very forcibly struck with the fact that enormous progress has been made in all things connected with mining science during the last 30 years. At that time at most of the pits here the coals were still drawn with corves, and the noise and confusion, to say nothing of the danger, was dreadful. Now all is quiet, not a sound to be heard but the knocking of the signals and the running of wheels. At the former period the voices of the banksmen could be heard at a great distance from the shaft, but now all is quiet and pleasant. The mode of ascending and descending shafts is, of course, entirely changed, and very much for the better in all respects.

A new winding-engine has been lately erected at Usworth, and certainly nothing can exceed the beauty of the workmanship in every part of this engine, and the very effective manner in which it performs its work. It is a horizontal engine, cylinder 48 in. diameter, and being worked by valves is under the most perfect control of the engineer. It is enclosed in a very handsome and ornamental building. And now to notice the change effected in the upcast shaft. Everyone who has been accustomed to descend and ascend those shafts knows well the horrid feeling, almost approaching suffocation, which is experienced, and formerly it was not uncommon for numbers of men to go to and return from their work by those shafts; and as many of them were dressed very like a highlander, having very short breeches and "hoggers" (stockings without feet) they were glad to fold any spare matters found about the shaft round their limbs to prevent them being scorched in passing the drift. The description of the Emperor of Russia was indeed not far from the mark. When he was taken to an upcast shaft at Walisend, in order to descend it, he recoiled with dismay, exclaiming, "My God, it is the mouth of hell." Now, we have a volume of 150,000 cubic feet of air per minute ascending this shaft without furnace-power, and entirely free from the vast volumes of smoke and dust usually found in such shafts. This fan is enclosed in a large, commodious, and handsome building, and the engines work with remarkable smoothness, and are finished in the first style. All the arrangements in connection with the engine are well worthy careful notice and study, but the most remarkable and useful apparatus is, perhaps, that for counting and recording the number of revolutions made by the engine, and this, of course, shows the quantity of air which has been circulated through the mine during any given time. This is an enormous advantage, not to be attained when the furnace is in use, as the viewer or engineer can ascertain at any moment the quantity of air circulating at that time, and also the quantity which has been in circulation during the time he has been absent, whether that time has been a few hours or has extended to days. It must also be conceded that the ventilation by fan must be more uniform than that by furnace. Where ample engine-power is provided the ventilation by fan is, indeed, almost perfectly uniform, while the ventilation by furnace is constantly varying with the state of the furnaces. The system of recording the revolution of the engine, which also shows the revolutions of the fan, gives a check which can hardly be got when the furnace is in use, so that the latter is very much dependent on the attention and carefulness of the men in charge.

It must also be noticed that the speed of this fan at the extremity of the vanes is enormous, even at moderate velocities of the engine, for 40 revolutions per minute is not a great velocity for the engine, but the speed of the vanes at that velocity is rather more than 60 miles per hour; and if driven up to 70 revolutions per minute, which will, probably, soon be done, the speed at the extremity of the fan will at that rate be 112 miles per hour—about double the maximum speed of the locomotive engine.

The event being one of considerable importance, not only in the locality but to the mining interest generally, we append a notice of the proceedings which has appeared in the *Newcastle Daily Chronicle*:—

EXPERIMENTS AT USWORTH COLLIERY.

Messrs. Elliot and Jonassohn, with the view of making their already efficiently-managed pit at Usworth still more free from liability to one of the chief dangers attending the working of coal, have just applied the principle of "mechanical," in substitution of "furnace," ventilation. The question of adopting one or other of the various patents which have during the past three or four years been introduced to the notice of colliery proprietors, has been maturely considered by Mr. George Elliot and his partner; and the results attained, as discovered by a minute and patient investigation of the several methods in operation in some of the collieries of the North, as well as in Wales, have been collated. Several considerations have had to be kept in view, the most important being, of course, that relating to the ventilation of the pits; another of no inconsiderable moment being that of the economy of the new mechanical appliance as compared with the old and prevalent system. All these considerations have been duly weighed and compared, and the result has been that a mechanical ventilator on the "Guibal" principle has been constructed at Usworth Colliery. The apparatus, which is the most complete, as well as of greater magnitude than any that has been introduced into any pit in the world, is now in operation—and hence an opportunity seemed to present itself for bringing together the coalowners of the North of England to survey the new machinery, and so inform themselves of its capacity and suitability for its work. Invitations were accordingly issued, and at the inspection among the gentlemen—concerned more or less immediately in the coal trade—who assembled, were, besides the two partners and Mr. S. B. Coxon, head viewer, Mr. E. F. Boyd, President of the Mining Institute; Mr. G. W. Elliot, jun.; Mr. James Easton, West House, Gateshead; Mr. Wm. Hunter, Newcastle; Mr. Wm. Cochrane, Newcastle; Mr. Richard Matthews, South Hetton; Mr. Alfred S. Palmer, Wardley; Mr. Wm. Taylor, Ryhope; Mr. W. Cockburn, Upleatham; Mr. George W. Southern and Mr. J. Willis, Government Inspectors of Mines; Mr. N. Morris, Washington; Mr. John Daglish, Tynemouth; the Rev. T. Thackray, M.A., Usworth; the Rev. J. Hunter, Mr. Wm. Hunter, jun., Newcastle; Mr. Thos. Hawthorn, Newcastle; Mr. D. P. Morison, mining engineer, Bulman Village; Mr. C. Berkeley, Marley Hill; Mr. H. Coxon, Newcastle; Mr. M. Weiner, Prussian Consul, Sunderland; Mr. J. A. Ramsay, Washington; Mr. Young, Lambton; Mr. John Newby, Usworth; Mr. Crone, Killingworth; Mr. A. L. Seavenson, Page Bank; Mr. W. H. Wood, Coxhoe; Mr. John Swallow, Harton; Mr. J. T. Ramsay, Walbottle; Mr. T. Bailes, jun., Newcastle; Mr. T. Sinclair, Gateshead; Mr. Wm. Hall, Haswell; Mr. John Gibson, Ryhope; Mr. R. Brown, Ryhope; Mr. Wm. Dakers, Seaham; Mr. G. May, North Hetton; Mr. Wm. Coulson, Durham; Mr. Wm. Dickinson, Derwent Cote; Mr. Wm. Moor, Hetton; Mr. T. Hepplewhite, Hetton; Mr. C. Bailey, Heworth; Mr. William Anderson, Chilton Moor; Mr. Thomas Murray, Chester-le-Street; Mr. J. Robinson, Usworth; Mr. F. W. Kollman, Mr. G. W. Wilkinson, and Mr. J. E. Newby.

The visitors made a close and careful inspection of the Guibal fan and the magnificent double engine by which it is driven, and the superiority of the contrivance over the old expedient of keeping up a sufficient current of air in pits was generally admitted. The method originally devised and still largely applied, as is of course known, is that of the underground furnace—a plan which would naturally suggest itself to the early mining engineers as being the principle in operation in the natural generation of atmospheric currents. As more effective ventilation became necessary, engineers set themselves to study how to produce, at the minimum of cost of fuel, labour, and wear and tear of materials, the maximum of ventilation, and the result has been the patenting of numerous inventions, known as the Struvé, Lemielle, Waddle, Rammell, Guibal, and others. In addressing the Mining Institute, when assembled at Glasgow, on this subject, Mr. D. P. Morison, mining engineer, contrasted the results obtained by the different systems. The Guibal ventilator he described as a "centrifugal ventilator, with eight or ten flat blades set backwards from the radius, encased with mason-work, and provided with a regulating shutter at the discharge orifice, to which is also appended an expanding chimney." "Nearly 150 of these ventilators," he added, "are at work on the Continent and in this country, of diameters varying from 16 ft. to 40 ft., and capable of producing volumes of air from 30,000 to 40,000 cubic feet per minute under depressions of from ½ in. to 6 in. of water-gauge. In these fans the theoretical useful effect of about 83 per cent. of the power applied to the shaft (or, as usually given, of 60 to 70 per cent. of the steam in the cylinders, the difference being the power absorbed in overcoming the resistance of the engine) has in almost every case been realised." The apparatus erected at Usworth is, as already stated, larger than any that has before been set up, the diameter of the fan being 45 feet. Amongst those previously fitted in this district are a Guibal, at Thrislington, of 36 ft. diameter; a Waddle, at Pelton, of 31 ft.; a Rammel, at Framwellgate, of 22 ft.; and a Lemielle, at Washington and Page Bank, the latter being 23 feet diameter. The results of experiments made with the Guibal at the Heworth Pit, and which was laid before the gentlemen assembled, was this:—Number of revolutions per minute, 40; average pressure of steam on cylinder, 7·81 lbs.; indicated horse-power of engines, 114·62; volume of air, 147,000 cubic feet per minute; water-gauge, 2·8 in.; water-gauge bottom of chimney, 0·75; horse-power in the air, 64·90; percentage of utilised power, 56·63. The splendid double engine, constructed on the diagonal principle, has been designed and arranged by Messrs. Black, Hawthorn, and Co., of Gate-head, and reflects the highest credit upon the firm, it being in every respect a first-class piece of workmanship. It is fitted with patent piston-valve; the two cylinders are each 36 in. diameter, and the stroke is 3 ft. The whole of the machinery is enclosed in a substantial and handsome building, erected a little distance from the mouth of the air-shaft, with which the ventilator is connected by a drift of 60 feet in length. The experiments were carried out under the direction of Mr. Morison, and the visitors were conducted over the works by Mr. Coxon. The full capacity of the ventilator, at 60 revolutions per minute, is 24,000 cubic feet.

At the close of the experiments the company proceeded to Usworth Hall, where they were entertained with an elegant luncheon. The chair was filled by Mr. S. B. Coxon; Mr. G. Elliot, M.P., and Mr. Jonassohn occupying places right and left. The loyal and patriotic toasts having been honoured with the customary enthusiasm, and "The Health of the Bishop and Clergy of the Diocese" having also been drunk, the Rev. Mr. THACKRAY made a brief speech in reply.—Mr. EASTON gave "The Health of the Owners of Usworth Colliery," who had invited them to witness the great improvements which had been carried out in the ventilation of the pit. He compared the present state of the colliery with what it was when he first knew it over twenty years ago, and congratulated the proprietors on its satisfactory and prosperous condition, much of which was due to the active agency of the Chairman. (Loud applause.) The application of a principle as old as the days of Archimedes to the ventilation of shafts had been most successfully accomplished—a result greatly due, he had no doubt, to the genius of Mr. Coxon. The toast was drunk with enthusiasm.

Mr. ELLIOT, in reply, thanked the guests for the hearty manner in which they had accepted the toast. He corroborated Mr. Easton as to the condition of the pit in 1848, since which time, however, many difficulties had to be overcome before bringing the concern to its present efficient state. At one time it appeared that their power of adequately increasing the ventilation in proportion to the extension of the workings was nearly exhausted, and it became a vital question whether more pits should be sunk, or whether it was possible to discover other means of meeting the emergency. He had been from an early time impressed with the conviction that some plan of mechanical ventilation would ultimately supercede the old method of furnace ventilation. He remembered that at the first meeting of the Royal Coal Commission he introduced the subject, and since that his expectations had been realised. When first introduced very little faith was placed in mechanical ventilation; but he had applied them in a good many places, and with invariable success—(applause)—especially in Wales, where they were the most necessary. These fans were not merely efficacious for purposes of ventilation, but they enabled the managers to remove all furnaces out of the pits, and, indeed, the engines, fires, flues, and everything connected with them. He had a very strong conviction that it was their duty to adopt every improvement that was calculated to save the miners' lives, and the abandoning of fires was one means of rendering the pit less dangerous. He might be condemned for advocating the new principle; but with their improved system of sending down steam-power to work the machinery, and of sending down air, there was no necessity in a general way to adhere to the old practice. If they resolved to use in future no lights except such as were protected by safety-lamps, how greatly would they reduce the number of accidents. Mr. Elliot referred to two explosions which had happened during the present year in connection with furnaces, and submitted that such instances were a strong reason for endeavouring to remove the cause. He thought no injustice would be done to coalowners if it were stipulated that henceforth there should be neither furnaces nor steam-boilers used in pits. He next spoke of the superior training which the young men who were in future to be employed in the management of pits were receiving, and recommended to their study how the deaths from explosion could be minimised. He felt they would accomplish a good work by getting rid of fires in the pits, and also, as far as practicable, getting rid of blasting with powder, and adopting the practice of ventilating the pits with the fan. He was not wedded to the fan, but he had the impression that it was the best thing that had been tried hitherto. It would protect the men from "standing fires," its use would be more economical than the furnace, and by its adoption they would only be doing their duty to their fellow-creatures who were employed in mines.

Mr. JONASSOHN also thanked the company for the honour they had done him. He bore testimony to the skill and energy which had been displayed by Mr. Coxon in the matter of the ventilator, adding that to that gentleman much of the success of the experiment was due. (Loud applause.) All the workmen in the colliery were perfectly satisfied that the change in the method of ventilation was for the better—(applause)—they could not say whether more air was sent into the pit, but they knew that the temperature was considerably cooler.—Mr. ELLIOT proposed in very cordial and feeling terms "The Health of Mr. Coxon," of whose moral influence amongst the mining population of the district he spoke in the highest terms of commendation. The toast was received in the most flattering manner.—Mr. COXON responded, and during his reply he took occasion to commend to their serious attention the system of ventilation which they had seen so successfully in operation that day, to the introduction, however, of which, he had to confess, he was at first adverse.—Many other gentlemen engaged in the conversation respecting the experiment, the speakers including Mr. Cochrane, Mr. Morrison, Mr. Morris, Mr. Easton, Mr. Berkeley, Mr. Willis, Mr. Southern, Mr. Simpson, Mr. Hepple, Mr. Taylor, and others. Opinions generally favourable to mechanical ventilation were enunciated, though the gentlemen were not altogether unanimous. As to any legislation on the subject, it was held that such would not be desirable until the system had been further developed.—After two or three other toasts had been drunk the company separated.

IRON, COAL, AND LEAD MINING IN MONTGOMERYSHIRE AND SHROPSHIRE.

SIR,—Extensive deposits of iron ore have recently been discovered in the parish of Llandysilio, Montgomeryshire, on the confines of Shropshire, and leases have been secured by a few enterprising mining gentlemen of several properties, adjoining each other, where three masterly veins of rich iron ore can be traced of an immense thickness, the ore of which gives an unusual high ley from samples taken close to the surface. The principal works can be arranged in close proximity to railway and canal communication. The bearing of the veins is nearly due east and west, two of which underlie north and the other south, at an angle of 12° from the perpendicular. The ore by analysis contains a sufficient quantity of lime for fluxing, which will greatly enhance its value. From the little explorations that have been made, and from well-known laws, as indicated by the surrounding strata, coal of a superior quality is known to exist, and it is expected that at no great depth it will be found in large quantities. Lime, if required, and timber for all purposes, are in close proximity. This will be an entirely new mining field, and when opened up will be the means of establishing a busy hive of industry for thousands of people, where hitherto nothing but a few solitary farmhouses have existed. The parties however, who have leased the several properties embrace amongst their number a mining and mechanical engineer, thoroughly acquainted with mining in all its branches, and his long experience in various parts of the world will, we have no doubt, enable them to bring to bear on this new and promising district sufficient capital to thoroughly open up and develope its hidden treasures. Great and well deserved attention is now being directed to the development of lead mines in North Shropshire, which will shortly rank—in fact, they do now—amongst the richest lead mines in the kingdom.

Passing on to the Llanidloes district, Montgomeryshire, here we have the Van, which at the present price of the shares is valued at 855,000*l.*, and other promising mines in the immediate vicinity; whilst we should not forget the Llangynog district, which is one of great promise.

There are other points of great interest in this county which must command the miners' and capitalists' attention, and we fully believe that this portion of our sea-girt isle is destined at no distant day to become one of the most productive in mineral wealth known to this generation. Capital, science, and practical knowledge are all that are required to make the principality of Wales rank among

the richest mineral producing countries of the world. The practical experience of late years, coupled with all the recent improvements that have and are now being introduced for the mining, milling, and extraction of gold from quartz generally on the Pacific coast of the United States and Australia, where 5 dwts. per ton leaves a profit, whilst the quartz in the Dolgelly district produces much more, proves that there cannot be any reason why the gold mines of Wales may not be made remunerative, where we have labour abundant and cheap machinery, if only practical men conduct the operations, and not amateurs, of which unfortunately there have been too many. There are but few countries that possess equal facilities for mining that Wales does. S. J.

Llandysilio, Montgomeryshire, April 18.

COLLIERY EXPLOSIONS, AND A PERFECT LOCK FOR SAFETY-LAMPS.

SIR,—Thinking it may be of interest to your readers to hear of a perfectly safe lock for Safety-Lamps, I send you the following particulars of a lamp which has been adopted at the Harecastle and Woodshutts Collieries, Stoke-on-Trent, for the last 12 months, and which has during the time given every satisfaction. We are now replacing the Clanny and Davy lamps throughout the entire colliery as fast as the old lamps wear out.

The locking of the lamp is accomplished by simply screwing on the lamp bottom with the hand, as in the old method. We have never had any attempt at tampering with this lamp, and the lock (which is exceedingly simple) being entirely enclosed within the oil chamber renders it impossible for any other instrument than the magnet provided for the purpose to unscrew the top, and any attempt to get at the light could only be accomplished by the entire destruction of the lamp.

The colliers like this lamp extremely well, as it is much lighter than the Clanny, and gives a very much better light. We highly approve of this lamp, both as regards safety and economy when placed in the hands of the pitmen; and one special advantage we find connected with them is that the collier takes much greater care of them when at work, because in case of the lamp being extinguished he has to take it to the station, where the 8-bar maguet is fixed, in order to get it re-lighted. The unlocking of these lamps by the apparatus for the purpose is very simple, and much more easily performed than with the ordinary key. I may mention that the patentees of these lamps are Messrs. Craig and Bidder, of the Victoria Graving Docks, Victoria Docks, London. JOHN H. GARRETT.

Harecastle and Woodshutts Collieries, Stoke-on-Trent, April 19.

RATING—TAXING—LEVYING—MINING.

SIR,—Your correspondent, "P.," writing on this subject in the Supplement to the Journal of April 8, having glided softly over many important subjects, giving merely the facts, that I hope to see many long and explanatory letters from gentlemen engaged in the varied subjects so modestly brought before us.

Mining is a speculation enchanting in the extreme, and thousands of honest men—and ladies, too—are at all times ready to come forward and invest all their little spare capital in the speculations of mining enterprise, with a hope of realising a fortune; and without doubt very many such hopes have been fully realised. I wish I could say all, but, alas! I am bound to confess that many hopeful and deserving investors have seen their last spare or superfluous shilling go, and never seen a farthing in return. A flattering tale to such is told, and with the firm grip of hope they hold until too late to loose.

The projected plan of our bold and far-seeing legislator, the Hon. Mr. Goschen, for taxing all mines is fair. Why should coal mines be taxed, and all other quarries and mines go free? No one can give a substantial reason, and all the twaddle that has been advanced by different gentlemen before committees of the House of Commons, and otherwise, to prove that no mines ought to be taxed falls into insignificance, shame, and confusion before the voice of reason and truth. Fortunately for the reputation of the Committee which heard the very plausible Mr. W. Mathews on this subject, they declined to recommend his suggestions and advice. No doubt the question at the close of his examination stood before them as at first, waiting a satisfactory answer, which will never be obtained. Why should I be made to pay, and my neighbour go free?

The question before the country and the House of Commons is not, shall mines be rated? Your correspondent, "P.," has given us a new idea of rating, and in my opinion a just one. I have before stated that mining is a speculation, but to whom is it a speculation? All coal and ironstone mines, &c., are let subject to minimum rents. I have known about 30 acres of coal mines let at a royalty, with a dead or minimum rent of 2000*l.* per annum; and so strong have the covenants of the lease been in favour of the landlord (poor man!), that in case this rent has not been paid by the poor tenant at the dates fixed, the lord has had the right to walk into the colliery, with power to sell all engines, &c.; and if not enough has been found at the colliery to cover the rent, royalty, cost, &c., due the power has extended to the poor tenant's house and person. It is, therefore, clear that to the landlords the word speculation does not apply; and to the everlasting shame of those who made this unjust law for taxing tenants, landlords have been allowed by law to receive their tens of thousands in rents and royalties, and never pay a farthing of rates and taxes on the amounts they have so received; whilst their poor tenants, who have expended thousands of pounds in sinking pits and opening mines, with a hope of making a profit, or—as your correspondent "P." puts it—"with a hope of getting a living," have been taxed on the full amount of the rent they have paid to their landlord, and that too frequently from their capital, and not profit. I agree with "P." that all rates and taxes ought to be paid by the owners of property, and not by the men who have to pay the rents and royalties, and, perhaps, never get back a shilling of their capital. Foul injustice is stamped on the face of our present system of rating, which screens the rich, at the cost of the middle classes and the poor.

It is true that in our metalliferous mines but few cases have been known of dead or sleeping rents, the uncertainty and risk being too great for such a custom as minimum rents, and the lords of such property have, as a rule, to wait until the ore is found, raised, and taken to market before they get rents or royalties; but when they are paid the landlords have them without the least cost or risk. I, therefore, contend that those who receive rents and royalties, which are the only sure profits of mines, &c., ought to be rated in common with every other rateable property towards the support of our local and national institutions, and not the tenants, who have all the risk, labour, and anxiety, and too frequently ruin, as it is well known throughout the world that although large fortunes have been made in mining, great fortunes have also been lost in it.

The readers of the Hon. Mr. Goschen's Bill will see that he intends to go into profits visible and invisible; we must, therefore, conclude that all who win must pay, in which case, no doubt, those adventurers who make profit in mining will also be called upon to pay (as well as the landlords) on their profits, after deducting such a fair percentage for the return of capital as the case may require.

R.

THE ROSEDALE IRON MINES.

Some very disparaging remarks having been inserted in the *Leeds Mercury* from a correspondent, "Semper Vigilans," we have been requested to publish the following reply, in vindication of the morality of the place, and in support of the system of management pursued by the officials:—

That some of the miners employed here do, after their fortnightly pay, indulge far more freely in intoxicating liquors than is good for them is, unhappily, both for the men and the proprietors, but too true; and everything has been done by the proprietors to lessen the evil, not only as a matter of duty, but also because the proprietors themselves suffer great loss from the non return of these men to their work at the proper time, in the disarrangement of the working of these extensive mines, and in portions of the staff and horses being necessarily unemployed until those men return. Having, however, had experience at other large mines of a similar character, I can unhesitatingly state that the evil does not exist here to the same extent as in some other places, and that the number of men that are to be found thus injuring themselves and their employers has been gradually diminishing. The proprietors have succeeded in inducing the magistrates to discontinue the licenses to two beerhouses near the estate, at which drinking and riotous conduct were carried on, while upon their own property they do not suffer any beerhouse, and the only publichouse belonging to them is the old "Crown," in Rosedale village, which had existed from a period long before they became the possessors, and which is necessary for commercial and other persons frequenting the locality, as they do, for business purposes, in large numbers.

It would have been only candid in "Semper Vigilans" to have stated, what is perfectly well known—that the proprietors rigidly enforce the closing of this inn on the whole of Sunday. There is another inn in West Rosedale not belonging to the mining proprietors, which, to their credit, is also closed during the whole of Sunday.

The mining proprietors gave ground and assisted in the erection of two chapels—one Wesleyan the other Primitive Methodist—which are well filled by miners and their families. A third chapel is about being erected by the Wesleyans, higher up the valley and nearer to the upper mines. There is a day-school built and supported by the proprietors in that upper locality, which is well filled during the week, and used on Sunday by the Primitive Methodists; and the proprietors have laid before the Council on Education a project for increasing that school and building a second under the provisions of the recent Education Act, in which they are only following their own example at their ironworks at Ferry Hill, where they have recently opened a school for 600 children, with reading rooms for the use of the workmen.

"Semper Vigilans" suggests payment of wages weekly, and "even twice a week," instead of fortnightly as now, on which I would remark that there are above eleven hundred workmen at these mines. The wages paid to these men for each fortnight approach 3000*l.*, and I leave it to any man of the least experience of such matters to judge of the practicability of "Semper Vigilans'" proposition.

It will be seen that the miners are not all of the drunken and improvident class "Semper Vigilans" would indicate, when I state that the men long ago formed a "sick club" amongst themselves, the annual payments to which (of 6d. per week by each workman) now amounted to about 1500*l.* per annum, besides which the same miners also subscribe for the payment of a resident medical man and his staff, and organisations exist among the men under which they farm land and keep their own cows for the supply of milk to their families and others, and nearly every married miner occupying a cottage has his pig in the stye. Most of the miners are intelligent men, who, regretting the failings which do exist, yet resent the wholesale imputations of "Semper Vigilans" as much as I do.

I venture, finally, to assert that there are no other works in North Yorkshire where more has been done for the well-being of the miners than at Rosedale, and it is a general and true remark of strangers visiting the locality that there is no district where the workmen have better cottages, or where their families appear more orderly, more respectably attired, or better behaved.

JOHN PARKIN, Superintendent of the Rosedale Mines.

THE PETROLEUM TRADE.

SIR,—Whatever importance may be attached to political questions in connection with the Black Sea, there can be no doubt that immense commercial interests are springing up in the countries belonging to Russia washed by the Euxine, which did not exist prior to the Crimean war. Since that event the Black Sea presents an entire change in its economy. The nucleus of a commercial steam fleet has been formed at Odessa. Railways already reach that city from St. Petersburg and Moscow, the chief towns of the Sea of Azof. Taganrog and Rostof have also a railway communication with both the capitals. The Crimea is likewise to be included in the network of Russian lines, and doubtless the Suez Canal will in time tend still further to increase the commerce which is so rapidly developing itself. Among the countries of the Black Sea the Caucasus may be said to be also rapidly progressing, although it is only a comparatively short time since Russia has acquired permanent sway over the hill tribes, who had rendered impossible every attempt at commercial and industrial enterprise in the surrounding districts. At present industry and commerce are being rapidly developed by the exploiting of the natural riches of the country, among which may be mentioned, as connected with mining, the obtaining of salt, coal, and petroleum. The towns of the Trans-Caucasus—Tiflis and Baku—are steadily increasing in area and population. Among the most striking features of the Caucasus is the range of mountains of that name, where but scanty researches have as yet been made as to its mineral wealth, but sulphur mines and bitumen springs have been discovered for some time. The range of the Caucasus extends across from the Black Sea to the Caspian in one unbroken line nearly 700 miles in length, forming throughout its whole extent a continuous mountain barrier, separating the vast steppes of South-Eastern Russia from the hilly and broken regions of Georgia and adjoining provinces, and constituting the natural barrier between Europe and Asia, or the boundary between the Caucasus proper and the Trans-Caucasus. It is indeed a singularly well-defined chain, descending at each extremity to the sea, and united on the south with the mountains of Armenia only by a low range of hills, which form the watershed between the streams flowing into the Black Sea and those that descend eastward towards the Caspian. It is thus, in fact, wholly unconnected with any of the other great mountain systems either of Europe or Asia. How little as yet is known of this country may be inferred from the fact that throughout its whole extent the chain of the Caucasus is traversed only by one natural pass, which has consequently formed in all ages the line of communication between the countries to the north and those to the south of it. This passage, commonly known as the pass of Dariel, from the remarkable defile of that name, cuts across the main chain nearly in the middle, and in the vicinity of its highest peaks. It is now traversed by a regular high road recently constructed by the Russians, and engineered in the same style as the modern highways across the Alps. The task was not an easy one, as the summit level attains the height of very nearly 8000 ft., thus exceeding all the carriage roads across the Alps, with the single exception of the Stelvio. The only other line of communication—it can hardly be called a pass—is that along the shores of the Caspian, between the last offshoots of the mountain range and the sea. But here, also, the mountains descend in one place so close to the waters edge, in the neighbourhood of Derbend, that the passage has been closed with a wall, while the numerous rivers to be crossed present so many difficulties that this line of route has been less frequented than the more central pass of Dariel.

In reviewing in my last paper the mining industry of Russia represented in the St. Petersburgh Exhibition, I alluded slightly to the production of naphtha or petroleum in the Caucasus. I now give you a *verbatim* translation of an article contained in the Russian *Mining Journal*, published by the learned committee of the Corps of Mining Engineers, which gives a detailed account of the present and probable future production of that most important article of consumption.

Among the most striking phenomena of the industries connected with the trade in natural products of the nineteenth century may be considered the obtaining of coal and anthracite in North America and in Western Europe, the iron industry of Great Britain, the gold mining in Australia, and the trade in mineral oil in the United States. In Russia, to these exceptional phenomena belong the trade in raw spirits, and the gold and silver mining of Siberia; and, besides, of late years have become most prominent the rich sources of naphtha, or mineral oil, in the Caucasus, with every indication that they will be of immense importance to the economy of the country. The northern and southern slopes of the Caucasian chain of mountains—the forelands—consist of strata of sandstones and conglomerates, clayey marls and limestones, belonging to one of the new configurations of the earth of the miocene formation. In these strata in many localities, but particularly in the provinces of Baku and the River Kuban territory, naphtha, or mineral oil, is to be found. Naphtha is the product of a chemical decomposition of vegetable remains, preserved in primitive times amid the different strata of the earth. In North America, and in our own Government of Vologda, the vegetable remains which have served for the formation of naphtha are contained in the ancient strata of the earth—in the Devonian and Upper Silurian systems. In the Caucasus, in all probability, the naphtha proceeds from the jurassic clayey schists containing coal. This mineral oil, or petroleum, exudes from the lower strata by the fissures to the surface, presenting the appearance of a greenish-brown liquid. Sometimes it varies, and is of different shades of colour, reaching the clear and transparent. The naphtha is almost invariably accompanied by salt water and carbonic acid gas. The salt gets into the water from the strata of the earth, and the gas is the product of the decomposition of vegetable matter. The appearance of the naphtha on the surface is principally owing to the force exerted by this gas; this action becomes sometimes so powerful that the mineral oil is thrown up in a fountain during several months. The natural sources, generally speaking, do not produce any great quantity of this substance, but in former times, and probably in times pre-historic, there existed enormous extravasations of naphtha on to the surface. This circumstance may be observed in the Caucasus, where are frequently met with considerable areas covered with torrents of hardened naphtha, or bitumen. In order to obtain a large quantity of petroleum it is requisite to dig wells, and to have recourse to boring. In the Government of Baku this article is obtained exclusively from common wells; but in the Kuban territory it is found necessary to bore holes from 30 sajins (210 feet) to 50 sajins (350 feet) in depth. This circumstance would tend to prove that the sources of naphtha in the Government of Baku are greater than those of the Kuban territory. It is, therefore, to be expected that in the first locality by deep well sinking by means of boring far better results may be obtained than in the Kuban territory, although there exist here, also, positive proofs of a particularly abundant supply of naphtha. As an instance of this may be pointed out the two wells which have been sunk on the banks of the river Kudako, which throw up daily, in the form of a fountain, 2000 poods (32¾ tons) of pure naphtha.

This alone will be sufficient to give one an idea of the rich resources of naphtha existing in the Caucasus, and for the sole reason that the sources of Kudako should not be looked upon as an occasional phenomenon. At any rate, all the geological data not only point to the possibility of discovering many other similar sources in the whole extent of the Upper Tertiary strata of both the declivities of the Caucasus mentioned above, but to the fact that in adapting the system of deep-well sinking by boring these sources will prove far more abundant. In Pennsylvania the mineral oil has gathered itself principally in the sandstone strata, which there form three horizontal layers, and the lower strata generally offer a greater supply of oil. The bore-holes at Kudako reach to the first sandstones at a depth of from 30 to 50 sajins (210 to 350 ft.); at the same time it should be considered that under these sandstones there must exist other more extensive sandstone layers belonging to the cretaceous system, which lie nearer to the sources of the mineral oil (*i. e.*, in the above-mentioned jurassic carboniferous schists), and, consequently, should contain a greater quantity of naphtha. As it would be more natural to assume that the subterranean supplies of naphtha in the Caucasus are distributed in a more or less regular manner than otherwise, in testing for naphtha, then, it would not be required to keep particularly to its natural sources. In conformity with geological considerations, we have come to the conclusion that the more a natural source abounds in gas, and particularly in mineral pitch which surrounds it, the less it is to be relied upon, for the reason that such sources in no way indicate any extraordinary abundance of oil below, but demonstrate only the existence of extensive fissures, by which, in the course of time, a considerable portion of the naphtha has escaped. And, in reality, as the issue of the naphtha on the surface depends upon the action of the gas which is collected below, similar to the manner in which every liquid charged with gas is ejected from the hermetically closed vessel which contains it, so the question arises, when is the greater quantity of this liquid to be obtained, when in testing for naphtha a place is met with which presents the characteristics of a vessel which has been opened for a long time, or when the bore-hole shall reach the reservoir of oil and gas, which until then had remained air-tight? We think that the question will be decided by everyone in the sense that in the last instance a far greater quantity of liquid will rise to the surface than in the first, as issuing from a reservoir the contents of which have been wasted to a great extent by nature itself. This very just argument may in future easily tend to diminish the importance of the Government's securing to itself those lands in the Caucasus where the most abundant natural sources of naphtha have been discovered. Let us assume, for instance, as it might happen in the Kuban territory, that in the midst of the land belonging to a private proprietor is situated a small lot belonging to Government, containing naphtha springs. If the speculating trader knows that in the vicinity of that lot, notwithstanding the absence of any outward indications of naphtha, the same can be obtained by boring or digging wells, he will doubtless far more readily rent the land from a private individual than from the Government, for the reason that a private person will never feel inclined to encourage the development of the naphtha trade on Government land situated side by side with his own property, and as a matter of course would find many means and opportunities to oppress the Government tenant by refusing him, for instance, fuel, the right of pasturage, &c.

To his own tenant he would, doubtless, endeavour to offer every advantage and convenience; we think, therefore, that the Government oil-producing lots, at least those situated in the Kuban territory, will prove a profitable investment only in a very few instances. In leaving these lots to private individuals the Government may, particularly at the commencement of the production, reckon upon obtaining a great quantity of naphtha, and consequently upon an increased income from the tax on mineral oil. As to the rest, the disadvantages which we have mentioned connected with the retaining by the Government of naphtha-bearing lots, they refer only to those instances where these lots are not built upon, are surrounded by private lands, and do not contain a sufficient quantity of forest trees and other requirements. But if it be true that for some springs the extent of land claimed by the Government does not exceed 4 dessiatins (11 acres), then in that case no good can be expected to accrue, because the lots of such a small area are not sufficient for the obtaining of naphtha, even from a single deep well or a bore-hole, where sometimes the most necessary requirements are not at hand, and particularly in the possible case of the Government lots being situated in the midst of lands belonging to a private proprietor, who in all probability would refuse everything to the Government tenant. The oil trader tenants who would wish, besides obtaining the petroleum in its crude state, to establish a refinery, would require a certain extent of forest land for supplying fuel land for dwellings, pasturage and kitchen garden, a certain area for fixing the plant for conducting the operation of boring, for the manufacture and storage of casks, &c. The quantity of land leased, therefore, should not be limited, but a certain payment should be appointed per dessiatina. In any case, in our opinion, the extent of land apportioned for the production of naphtha must not be less than 10 dessiatins (27 acres). It may not be superfluous to add, if the mineral oil traders in the Caucasus should experience any want of fuel, and presume that it is to be got in the vicinity from forests belonging to others, they will not scruple to take advantages similar to the private gold miners of the Ural, from whom the forests belonging to the Orenburg Cossaks have suffered to a great extent. Let us now turn to the probable quantity of crude naphtha which can be obtained yearly in the Caucasus. In the Kuban territory there exists about 50 mineral oil basins, representing an aggregation of enormous torrents of hardened naphtha (kir), natural and artificial pits and springs, where the naphtha, together with gas and salt water, percolates. Of such small pits and springs of petroleum there are not less than 600, yielding in the 24 hours about from 1 to 20 vedros (3¼ to 65 gallons) mineral oil. In the whole territory there have been only three wells sunk by boring, under the auspices of Mr. Navositsef, to the depth of 50 sajins (350 ft.)—*i.e.*, reaching the first naphtha-containing limestone stratum, and of such strata there must exist two at least, the lower one in all probability containing a much larger supply of mineral oil (see the evidences quoted above). Of the three wells sunk on the River Kudako* by boring, only two are now in action, and each well throws out daily, as stated above, at the least 1000 poods (16¼ tons) of naphtha (without reckoning the water). In the Kuban territory, with the most superficial researches, 100 localities may be found where from a bore-hole (in depth of from 50 to 100 sajins) petroleum may be obtained, in all probability, quite as abundantly.

If we consequently assume that with the extension of the naphtha business in the Kuban territory 100 wells† are sunk by boring, yielding a daily supply of 1000 poods (16¼ tons), which might continue for two years, we get at the least 36,000,000 poods (580,675 tons) of naphtha yearly. Taking into consideration that the mineral oil sources of the Kuban territory are not so rich as the sources contained in the eastern slopes of the Caucasus, it will be easy to foresee the enormous benefits which will accrue from the development of the naphtha trade in the whole extent of the Caucasus, provided the Government hastens to abolish the monopoly at present existing in connection with this important matter, and establishes the free working of oil mines on Government lands. Thus, if we assume, without any exaggeration, that with the proclaiming of a free naphtha trade in the Caucasus, there can easily be sunk by boring 200 wells‡, producing mineral oil, the yearly production of crude naphtha in the whole

* The name Kudako is derived from the words Kuda, pitch; and Ko, to exude.

† In the United States of North America, in Pennsylvania alone, there are about 8000 wells, averaging 560 feet in depth.

‡ Taking this number (200) for the Kuban territory and Baku Government, as well as the other districts of the Caucasus containing oil.

of the Caucasus would reach the figure of about 70,000,000 poods (1,129,031 tons). Calculating the cost of deep wells, and particularly those which have been bored, it would appear that for the obtaining of this quantity of naphtha a capital would be required of a maximum of 2,000,000 roubles (250,000*l.*); at the same time, a pood of naphtha would not cost more than 3 copeks (3d. per cwt.) The crude Kudako naphtha is now sold on the spot at not less than 40 copeks per pood (3s. 4d. per cwt.); and at distances of from 20 to 50 verts (14 to 34 miles) from the River Kudako, the price per pood of this article reaches 1 rouble and 2 roubles (8s. 3d. and 16s. 6d. per cwt.) Assuming that the Government might easily obtain a considerable income from the sale of Caucasian naphtha, which is conditional upon the richness of the mines themselves, the question arises how soon will it be able to obtain this income? The Government may accelerate a quick return from mineral oil mines, first, by abrogating the existing monopolies in connection with the obtaining of that product upon the expirations of the terms of the lease of the naphtha sources; secondly, by taking the initiative in establishing technical departments of the naphtha business, and the forming of convenient means of communication for the conveyance of the mineral oil; and in reality, in the latter instances, where the income of the Government is in direct proportion to the quantity of naphtha obtained in, and exported from, the Caucasus, the Government cannot depend upon realising a speedy income from the sale of this article, because in the Caucasus, at present, the means of procuring the naphtha in a large way by boring, are comparatively speaking, little developed, and there is a lack of practical experts in the business. Besides this, the Caucasus does not possess proper ways of communication for the convenient carriage of the mineral oil at every season from the place of production to the seaports. All these disadvantages which we have mentioned will, of course, disappear in the course of time, in accordance with the general rapid development of Russian commerce and industry; still, all this will take place in the course of time only, and, therefore, the naphtha business, in the presence of the actual state of things in the country, will not be able readily to afford the Government any large revenue. If we were even to suppose the connecting by railway of the towns of Rostof on the Don, and Vladicaucasus and the Caspian Sea with the Black Sea, in the direction between Pati and Baku, then even the naphtha business will not be able fully to develope itself, even with all the vast superabundance of crude mineral oil. With the existence of the latter line the trade in refined oil in the province of Baku might possibly gain some advantages, provided the product at the ports of the Black Sea be cheaper than the foreign article. But both these railways would not afford any benefit to the naphtha trade of the Kuban territory, where the navigation of that river should be at once established, opening up a communication with its left bank and the principal mineral oil basins by means of common macadamised roads. With the opening of the navigation of the Kuban, and the forming of the above roads to the extent of 300 versts (200 miles), the naphtha business will rapidly increase in the Kuban country; in that case the conveyance of Baku naphtha by rail, even to the ports of the Black Sea, will be already unprofitable; the mineral oil of that district will remain an article of trade in the surrounding country, the ports of the Caspian and of the River Volga, whereas the Kuban naphtha may be exported abroad and to our southern provinces.

We mentioned above that with a capital of about 2,000,000 rubles, it would be easy to obtain in the Caucaus up to 70,000,000 poods of crude naphtha yearly. For the purpose of manufacturing this quantity of oil into kerosin every year it would require the establishing of 30 large refineries, at a cost of at least 15,000,000 rubles (1,870,500*l.*) It is doubtful whether such an enormous capital can be obtained, even in instalments and on short terms, for the exploiting of the manufacture of kerosin alone; on the other hand, the amount of 2,000,000 rubles, with the establishment of convenient ways of communication, the cheapness in obtaining the crude oil, and the enormous demand for lubricating purposes, instead of vegetable tar, on the whole extent of the South Russian territory, which is without forests, may easily in a short time be brought to yield a yearly production of 70,000 poods of raw naphtha. We, therefore, think that in the Caucasus for the beginning the attention of traders will be devoted exclusively to the obtaining of crude mineral oil, and not to the manufacture of kerosin, which would require extensive means, besides having to compete with the foreign products, which competition is as yet so considerable that it might stop the profitable production of that article in Russia, or at any rate tend to diminish its value in foreign markets. It is evident from what we have stated above that in order to obtain a considerable and quick return from the Caucusian naphtha, it is imperative at the present moment, and first of all, to direct ones attention to the establishment of ways of communication from the principal mineral oil basins to the sea ports, the post and trade roads in general; and also to abolish for the future every kind of privilege in the obtaining of crude petroleum, and to establish this trade on free principles. We are of opinion that if the mineral oil sources in the Caucasus are deprived of proper means of conveyance to the principal commercial centres, it will take a long time before the trade developes itself. As regards the question whether the toll should be imposed on the raw material, or only on the products of its distillation, we offer the following data. At the time when in North America the distillation of mineral oil had not yet been introduced the raw material was taxed; on the development of the manufacture of kerosin the tax was taken off the raw material, and transferred to the manufactured article. Besides, crude petroleum is at present used for lubricating purposes instead of oil and tallows, as fuel and for lighting purposes, with a mixture of air (photogenized air).

Not long ago we received a written statement from a respectable St. Petersburg firm to the effect that in Russia there had been sold in a very short time 661 casks of Virginian natural lubricating oil at 6 rubles per pood (49s. 8d. per cwt.), consequently dearer than kerosin. In the Caucasus in general, and particularly with the establishment of good roads, the principal mineral oil trade will be entirely confined to the crude article, and not to the distillation, as a process at once expensive and complicated. Raw naphtha can be obtained with small means in enormous quantities, and sold at a profit to the rural population of the whole of the South of Russia at least, where a great deal of tar oil is at present consumed. It follows, therefore, that for the first the Government will be able to obtain a considerable profit from the sale of crude mineral oil. As regards the computing of the excise measure, it should be remarked that the naphtha business cannot be subjected to the same rules which exist for the distilling of spirits in Russia in the determining of the quantity of spirit distilled from the capacity of the vats, for the following reasons that different sorts of naphtha do not always yield the same quantity of illuminating products, that the quantity of these products depends also upon the system adopted in the distillation; it may depend upon the apparatus itself, or whether the manufacturer desires to distil to the last, or wishes to leave a certain quantity of heavy oil, which he can sell separately for fuel, for lubricating purposes, or use for extracting paraffin.

To limit these conditions to one and the same rules would be tantamount to oppressing industry. In conclusion, it will be necessary to point out the importance of scientific assistance and instruction which can be afforded by the mining engineers and geologists in connection with the naphtha industry, from whom may depend the discovery of fresh sources of naphtha in the success of the exploitation. Without going further into the matter, we need only say that the importance of the geologist in connection with the mineral oil question is in so far conclusive that the information afforded by him would enable the sphere of action of the naphtha business to be extended, for the very substantial reason that he can point out to the speculator many reliable sources of mineral oil, besides those which show themselves on the surface. The directions given by the geologist should not be limited alone to the traces of naptha, but consist in the following of the anticlinal upheavals of the strata, and particularly in the discovery amid the mineral oil basins of the deep water-drift valleys which lie crosswise and lengthwise of the anticlinal ridges. Being in a position to determine such localities, the geologist should publish detailed instructions, expressed as clearly as possible, and illustrated by drawings, showing the points most favourable for the discovery of mineral oil; these points being designated by particular signs on a detailed map. The geologist should also, if possible, personally point out to the speculator trustworthy localities, and dissuading them from working on lands containing deep valleys filled with alluvium, if even the same should show natural traces of mineral oil. In such places the naphtha is situated more or less at a considerable depth. If among other things in the development of the mineral oil business the advice of geologists is of great moment, none the less important is the necessity and requirement for persons whose duty is to point out the best mechanical means for obtaining mineral oil in different provinces. This method, consisting in boring, would constitute the principal mining operation by means of which the naptha is brought to the surface.

In the American petroleum districts there exist many localities where all manner of boring instruments are to be bought, together with pumps and portable engines. In Russia there are no depôts for such articles. It would, therefore, be of particular benefit to the country if the adminstration of the mining department of the Caucasus were to make arrangements for supplying the towns of Ekaterinograd, Tiflis, and Baku, for instance, with one set of samples each of all the appliances and tools required in the operation of boring for mineral oil, and, besides, to sink three or four wells as models, in order to demonstrate the advantages derived in obtaining naphtha by this process, but chiefly to afford instruction in the art of boring, with the view of forming a body of master well-sinkers, who would be useful to the country, which at present depends entirely on foreign aid—at least, in the peninsula of Kertch and the Kuban territory. Without proper instructions in this business the naphtha trade may lose in this respect—that it takes a long time to convince speculators that naphtha in great quantities is to be obtained only by boring to a depth of, for instance, 200, 350, or even 700 ft.; they will still go to work in the old-fashioned way, with short probing-rods, digging holes, making cuttings, uselessly ruining a lot of land, and will, for all that, never reach the tertiary strata of limestones which particularly abound in liquid petroleum. Besides that, many will not venture upon boring, not knowing how to go about it. It is, therefore, of paramount importance that there should be sunk for the beginning several wells as models, where proper instructions in the art of boring could be given.

J. RUSHFORTH.

Farleigh-road, Stoke Newington.

LANDER HILL, AND ITS MINES.

SIR,—The mines of this section (Austin) have acquired a celebrity next in importance and extent to the famous Comstock mines, not only at home but abroad. The quantity and quality of its ores fully entitle it to such a distinction. There is, nevertheless, a difference between the two, which constitutes another kind of distinction.

The term "zone" would appear better to convey an idea of the Comstock vein than that of "lode," as in some places it is ascertained to be 500 ft. in width. It is almost unnecessary to say that the ores occur in isolated deposits, or chimneys, and the zone, or vein, is subject to alternate contraction and expansion, as protuberance or depression takes place in the upper and under walls.

The body of the vein partakes of the character of the contiguous bed rock, but in a higher state of decomposition, which on the east wall, or upper, is sienite, whilst that of the west, or under, wall is, from a little difference, apparent or real, in its composition, termed propylite, which, of course, is a decidedly technical term, and applied distinctively to one of the members of the porphyritic confraternity.

The veins of Austin are comparatively small, but well defined, and subject to vertical and horizontal faults. These, as might be supposed, have caused considerable embarrassment and entailed heavy loss on the miner, more particularly as the management—or superintendence, as it is termed here—has almost invariably been in the hands and under the controul of men in their novitiate of mining. It is not uncommon, however, for persons of this class to consider every new comer, from whatever country, with whatever experience and attainments, as belonging to that category, and they themselves at its antipodes. The bed rock is granite, imperfect in the geological sense, and secondary, as its formation has not occurred under sufficient pressure to obliterate the marks of its stratification. This granite, though termed hard, is only so comparatively, when considered in respect of the perfect and primitive granites of Cornwall and Devon, and is more congenial and equally adapted to facilitate mining on an extensive scale, on account of its prevailing system of faults. It seems a little singular, and sounded to me as very awkward when I first came to this part of the country, to hear a condition of things without which, it is to be presumed, that not a pound of ores could be found in that class of rocks, subjected to unmitigated execration. It was a very common occurrence to hear men entrusted with the management of mines conclude their description of the merits of the mines under their direction with the invariable peroration that no break, fault, or cross-course existed throughout the whole claim. That which was known to be, from the experience of ages, essential to and inseparable from successful mining throughout the world was here considered the bane to all success. The veins of Austin, though small, are numerous, and consist of a series of approximately parallel veins and their adjuncts, the latter oblique to the former, and generally terminating at either extremity in the adjacent main lodes. Intersections occasionally occur, but conjunctions are much more frequent. These caunter veins would be great auxiliaries to the success of mining, if properly comprehended and systematically pursued, notwithstanding their associating at least one characteristic which renders them unstable. It is this: their obliquity to the main lodes, supplemented by their more rapid underlie, causes them to change positions relatively with the main lodes to their occurrence at the surface and in depth.

To make this matter a little more clear, for the purpose of being better understood, I must add that the point of junction of two such lodes, relatively situate, must be necessarily vacillatory—lineally dipping in the main lodes in proportion to the obliquity and greater underlie of the approximating, or obtruding, vein. Not unfrequently the point of junction—or horse, as it is provincially termed in Cornwall—varies as 1 to 1 in depth, either receding or advancing, as the case may be, from or to a common centre—say, the working shaft. To illustrate this, a claim which extended at the surface from a given point 500 ft. north and 500 ft. south, would be at the depth of 500 ft. wholly lost to the proprietors on one side or the other, according as the dip might be.

This will still better appear from the fact that all mining claims here consist of linear feet on the line of the respective lodes, denoted by some practically indelible mark on the surface, generally an incline on the line of the lode itself, which incline, if varying in its bearing from a right angle to the line or strike of the lode, will gain or lose in length of ground on one or other side of such shaft, in proportion as depth is increased and divergence perpetrated. This is vitally important, as affecting the value of claims embracing such lodes, for if the earlier auxiliary lodes are passing away beyond the limit of original claims, others will succeed them, with all the regularity and routine of a serial system. I have tried to be explicit on this point, because it may be inferred the necessity of both a minute and comprehensive system of mining.

If Austin has lost some of its prestige it is because it has lacked such a system, which, to begin with, should have embraced a much wider field. Twenty or thirty of the original claims ought to be compressed into a single concern, instead of so many companies trying to make so many profitable investments out of what would only at best constitute one moderate or average sized mine. The shifting character of the lesser lodes, combined with their "faulting," together with the faulting of the main lodes, the deposits of which are subject to linear influences, render it imperatively necessary in order to success that the chances should not be comprised within ridiculously circumscribed limits. Why should not the anatomy of a district like Austin be perfectly understood? It is perforated in a thousand places on Lander Hill alone, and the bed rock is of one prevailing uniform class, and but a comparatively short time would be required for even an ordinary observer to become familiar with every leading lode in that section of the district, as well as with the principally important junctions of the secondary, dependent, or contributory lodes. That Austin would be better understood, as well as represented, by the past cannot be doubted. More surprise need be occasioned by the quantity of ores which have been extracted than from the failure of the district to continue its yield. If all point of operations in mining were to be discontinued on becoming poor, there is no alternative, they would continue so. This, like many other districts in Nevada, has to be subjected to an entirely new regime, as well as entirely different auspices. The presumption here has been—and it would be well if it had become a thing of the past—that mines which will not pay from the surface downwards—at least, self-sustainingly—are unworthy the slightest attention; for this, amongst other allegations, that they are not in harmony with the rapid advance of surrounding events. None but antiquated, or fossilised, individuals, it is affirmed, would think of devoting one or two years to the opening of a mine, whatever its promise or prospective value. It is remarkable, however, that the acumen which dictates such views has ever been, as it is now, unaccompanied by either the light of reason or experience. Austin to redeem itself has to do what it should have done years ago—enlarge the area of individual mines, and then apply a comprehensive, intelligible, concentrated, and vigorous effort to their development. What it has yielded is, in my opinion, only an earnest of what it is capable of doing. Nature has, unquestionably, been prolific in that section; and it is no less clearly within the range of man's perceptive energies to detect the avenues through which her most profuse benefits lie scattered; the most important of which are at the points of junction of the several lodes, and the linear dip of the ores they contain. I express myself the more freely on the district, because personally I have no interest whatever in it, and because I have had an opportunity of observing its responses to the miner's practical appeals during the past five or six years. My principal reason, however, for writing you in regard to the district is because so many communications are sent to you, and courteously published, with your accustomed liberality. My conviction is that did I not know the district I must have been misled by perusing some of them. *Exparte* statements, to say nothing of exaggerations, work no benefit to mining, nor the districts it is associated with.

Ellsworth, Nye Co., Nevada, March 23. ROBERT KNAPP.

MINING IN CARDIGANSHIRE.

SIR,—The letter of your correspondent, "Observer," in last week's Journal, is not, in my opinion, calculated to do good to the mining interests of this county. It says too much, and yet too little, giving undue importance to one of many acts of deceptive colouring, without being able openly to expose the delinquents. Most residents, however, are able to supply the reticency of your correspondent, and to fix the cap on the fitting block—for, of course, they heard of the wonderful ore-cased pile of refuse which was to be seen at a certain place north of Talybont, and was estimated at one time as containing 1600*l.* worth of lead ore, and also of the fabulous reserves in the mine, yet there is not one so locally situate, with any pretence or foresight, who would think of hazarding a mite to the tender mercy of the discoverer. But the *Mining Journal*, Sir, is spread far and wide, and read by "One and All" throughout the kingdom; why, therefore, aggravate and give such undue importance to the scandal which has arisen from this attempt at magnifying a discovery?

"'Tis my vocation, Hal; it's no sin for a man to labour in his vocation."

Still it is hard to suppose that industry and research properly applied on the part of this disciple could not be rewarded with a rich run of ore ground in some place or other within the limits of this famed silver-lead ore district; yet, Sir, I ask you what would be the result of "Hal's vocation" then? "Wolf, wolf!" has been called so often that as a signal of distress it would be totally disregarded, so also any extent of good fortune would be pooh-poohed and utterly disbelieved. Personally, however, I know nothing of the deception alleged with regard to the actual value of the discoveries in the mine; but if a mistake—to use a mild term—has been made the sooner it is acknowledged the sooner this scandal and its direful effects on legitimate mining will be forgotten.

Aberystwith, April 19. VERITAS.

MINING IN SHROPSHIRE.

SIR,—Having a little time on hand, and being in the neighbourhood of the mines in Shropshire, and from five to ten miles from this place, I thought I would visit some of them at least. Taking train from Pontesbury to Minsterley, thence through the fields, I soon found myself on the SNAILBEACH washing-floors. Much said about this valuable property would be of little avail, as everyone who has any knowledge of lead mines must have heard of its large return and profit—suffice it to say the mine is quite as productive as ever. Next we come to a comparatively new concern, CENTRAL SNAILBEACH. Here I find they are pushing on and proving the lode in depth, believing that a profitable mine will be the result. I wish them every success, for they are well deserving of it, having laid out a large amount of capital in one part of their sett, called Mytton Dingle. The prospects are good; and if they do not open up a profitable mine at the Crow's Nest, still they need not fear that by proper development a good mine will be opened up in this part of their holding.

The next mine is PERKINS BEACH, where they are making much stir in washing and sending off the ore; this is a most promising mine, having sold, I am informed, something like 2100 tons of lead ore, most of which was taken from above the deep adit. The prospects of this mine can be understood by the reports and from information to be had from the miners in the neighbourhood—in fact, one old miner told me he got 30 tons and upwards from one of the caunter lodes, there being several, "not a great distance from each other, all bearing of lead" above the deep adit in about a fortnight. The former company, having what is called the Stiperstones Mines, comprising Perkins Beach, Hill sett, Pennerley, Oven Pipe (now Tankerville), Round Hill (now in Tankerville sett), West Tankerville, and North Tankerville, but had not sufficient capital to work out and properly develope so extensive a property, after spending some thousands in different sections in a few years operations were stopped in all of them except Tankerville, which with the other mines came into the hands of Mr. H. Jones, who laid out from 5000*l.* to 6000*l.* in Oven Pipe and Pennerley, but Perkins Beach was entirely neglected for some time, until Mr. Jones disposed of this portion to Mr. S. H. Keough. Sometime after this Mr. Jones disposed of all his interest in the above mines, and Mr. Keough has been instrumental in bringing this mine to its present position, and there is not the least doubt but that it will rank amongst the best mines in the Shropshire lead district—having within its limits many north and south and east and west lodes, most of them producing lead ore, and some large quantities at the present time. Although the mine seems to be neglected, the time is not far distant when the mining community will be obliged to acknowledge the fact of its being one of the best, from the large courses of ore laid open and profitable returns made.

The next mine adjoining this is the celebrated TANKERVILLE (late Oven Pipe). This mine needs nothing more than to say its riches are being developed, especially in sinking the shaft, the same going down in what might be termed a gulph of ore, leaving large reserves.

I shall continue my rambles over the lead-bearing district, and will write you again on the subject shortly.—*Pontesbury, Salop, April* 19. H. G.

THE PEN'ALLT MINE AND MACHINERY.

SIR,—In the Supplement to the Journal of April 15 I notice that at the ordinary general meeting of the shareholders of the Pen'Allt Mining Company some strange remarks were made, both in reference to the mine and the machinery. Having supplied the machinery, I feel bound to say something in reply to the extraordinary and contradictory observations made at the meeting in question. As regards the fine slimes going to the river, the visiting directors have disposed of that. If it were found going to the river it ought to have been stopped in the first instance, and not allowed to go on for months, until Mr. Bond found "that tons had gone to the river," a statement which I am inclined to doubt, notwithstanding the van or the assay.

I have said the statements are contradictory. The agent reports—"After a series of delays the machinery is at last working satisfactorily." After these series of delays, and inspections of similar machinery at full work, the agent must have had sufficient time to form something like a correct opinion on the matter, which he did form, and declared it to be entirely favourable. But time wears on: 100 to 150 tons of silver-lead ore dwindles down to 7 tons, imperfectly dressed, and then the agent turns face about and declares it is the fault of the machinery. Now, Sir, having for some 20 years been in the habit of putting up mining machinery, you may be sure it is not the first time I have seen these gigantic estimates of ore at surface sadly mawled by the erection of dressing machinery. I can assure you that I felt certain that this result would ensue at Pen'Allt, but it is something quite new to inform the public that machinery has performed such incredible antics as that at Pen'Allt. The rough ore has been put out of sight altogether; neither inspectors, professors, agent, or directors can tell where it has gone to. The fine ore, impalpable slimes, does not seem to have escaped so cleverly, "the machinery having deposited it in the river." But the most curious part is the 50 tons that was to be ready by the end of January dwindling down to only 28 tons. And now what do we see? Prof. Forbes dedwindling down to only 7 tons, and Capt. Kitto makes it less. Can it be that this German machinery has actually walked off with the 21 or 22 tons of ore missing? Doubtless, something is to blame, and it must be the machinery, no one seeming to think anything else. But I venture to suggest (and am sure that my suggestion will be endorsed by every competent and disinterested person) that the estimates were altogether outdone, and were not in any way justified by either appearances or facts; and when the ore comes to be cleaned up, instead of admitting the mistake, those who made the promise seek to make the machinery the scape-goat. I further assert that whatever ore was at surface and passed from the crusher to the dressing machinery has been all saved by it, unless some of the fine slimes which have been allowed to pass off, either by a lack of knowledge or of care.

I read a report last November, in which it was stated that "the mine (Pen-'Allt) was one of the best, if not the very best, in the Principality," on what grounds the results will show. It is most ridiculous to suppose, or state, that it cannot be told where the ore has gone to, or insinuate that the machinery has caused it to vanish, or to make 100 or 200 tons into 7 or 8. The fact is this, there has never been any ore that would pay the cost of any one department. This could be easily established by taking a day's crusher work, saving it and dressing it by the most certain hand process. This would be a reliable test. That of Messrs. Dixon and Bond proved nothing, except that the dresser had suffered slimes to pass into the river, in what proportion or value the test does not establish. Besides, what can be understood by the statement of Mr. Dixon? He says that "Mr. Bond took 8 lbs. of the impalpable slimes from the river, and vanned it to 2¼ lbs., which yielded 35 per cent. of lead, with 24 ozs. of silver to

the ton." To the ton of what—to the ton of stuff or the ton of lead? But can Mr. Bond tell from what quantity of slimes, as crushed, this was the produce of? If he cannot, what is the experiment worth? What does it show? Why, simply that the company is likely to start on a wrong basis, as they have already done, and the result would be again—wonder where the ore has gone to.

If the directors do really wish to know the value of the ore they are treating let them take several samples of the stuff they are crushing daily for a week, and have some one present who will see that they are fair samples, and have the whole mixed and washed by a competent dresser, and also assayed; they will then know what is the value of the stuff they are treating. Going down the river is quite the wrong end. It is all very right to test the care of the person in charge of the dressing, but gives no idea of the value of the mine. Everyone knows that the deposits in the bed of the river would be the heaviest portion, the lightest being carried off, and these river deposits will be more or less rich, according to the strength of the steam, and it would be quite possible for such deposits to turn out as Mr. Bond found them, when the mine actually would be utterly valueless in a commercial point of view.

As regards the value of the machinery (notwithstanding Capt. Glanville's advice, which I venture to prognosticate will not be taken), if anyone interested in efficient and economical dressing of ore will come to Aberystwith I will at more mines than one show them the same sort of machinery doing all they would desire. Opinions and statements are of precious little value, but there is a way of having such matters tested the way I have pointed out, and I have little fear of the result.

With regard to the prospects of the mine in depth, I am no miner, and leave that to gentlemen like Prof. Forbes and Capt. Kitto, who should both from their reputation be competent guides. In conclusion, let me state that neither Capt. Glanville, Mr. Bond, or any other person by any means, either new or old, can extract 12 tons of clean ore from such stuff as was outside the mine at Pen'Allt in November last in three months, and crush the stuff with the present crusher.

Aberystwith, April 18. GEORGE GREEN.

WEST DRAKE WALLS MINE.

SIR,—Being considerably interested in this mine, and being able to obtain very little satisfactory information relative to its present position and future prospects, allow me to ask the pursers, Messrs. Richard Clogg and Sons, of Liskeard, through the medium of the Journal, a few questions:—

1.—First, then, why have the men employed under them been again removed from the 40 fm. level before the lode has been intersected?

2.—Why is not the sinking of the main shaft vigorously prosecuted?

3.—Why do they not employ a full pare of men for that purpose, instead of six only?

4.—Why has the 40 fm. level cross-cut been almost entirely abandoned for the last twelve months?

5.—Why has not more work been done at the 50 fm. level?

6.—What is the object of the rise at the 50 fm. level?

7.—After intersecting the lode in the cross-cut north in the 50, were any steps taken to drive east and west on the course of the lode; and, if so, with what results?

I write on behalf of other shareholders as well as myself, feeling sure that if this mine were properly and continuously worked it would soon enter the Dividend List. BONA FIDES.

ROMAN GRAVELS MINING COMPANY.

TO THE EDITOR OF THE "MINING JOURNAL."

SIR,—Will you oblige me by inserting the following correspondence on a matter of much importance to the shareholders in this company?

Stock Exchange, April 17. R. H. M. JACKMAN.

TO THE SECRETARY OF THE ROMAN GRAVELS MINE.

SIR,—My attention has been called to a paragraph in the *Mining Journal* of the 15th instant, respecting some proceedings that have been taken against the purchaser of this mine. Will you be good enough to inform me whether the company is involved in any litigation, as several of my clients are very anxious upon this subject? R. H. M. JACKMAN.

Threadneedle-street, London, April 17.

Roman Gravels Mining Company (Limited), 20, St. Helen's-place, London, E.C., April 17.

SIR,—In reply to your note of this date, I beg to inform you that there is no truth in a report which has been in circulation as to the company being involved in any litigation.

The proceedings to which reference is made are between two individuals, and in no degree affect the company. I am glad to inform you that the mine never looked so well, and is opening out to the entire satisfaction of the directors and manager. F. R. WILSON, Secretary.

R. H. M. Jackman, Esq., Stock Exchange.

[For remainder of Original Correspondence see to-day's Journal.]

GREAT MOELWYN SLATE QUARRIES.

The following are the prices realised for some of the lots at the sale by auction of the plant and effects of this property, near Festiniog, North Wales, by Messrs. WHEATLEY KIRK and PRICE, of Manchester, on April 14:—

— cwt. wrought-iron single-headed rails, various, at 5s. 2d. per cwt.
— cwt. round and square wrought-iron, at 5s. 9d. per cwt.
Single-geared crab, with iron barrel, 2 ft. 4 in. wide, 9 in. diameter, in iron frame, 1*l.* 6s. [2 in. deep, at 5s. 11d. per cwt.
— cwt. wrought-iron single-headed rails, 12 ft. and 15 ft. long, 2 in. wide,
— cwt. steel wire-rope, 3 in. circum., chains and hooks, at 18s. 6d. per cwt.
One flange pulley, 2 ft. 4 in. diam., 3 in. face; one ditto, 6 ft. diam., 6½ in. face, with extra flange pulley, at 2s. 8d. per cwt.
Pair of winding drums, one drum 2 ft. 4 in. diam.; one ditto, 5 ft. 6 in. diam., wrought-iron shafts, pedestals, and brasses; two cast-iron stands and girder, break, connecting rod; lever, on wood beam, in excellent condition, at 9*l.* 10s.;
Six wagons, each 6 ft. long, 3 ft. wide, 1 ft. 4 in. deep; four cast-iron wheels, axles, coupling chains and hooks, at 23s. each.
Covered wagon, 9 ft. long, 3 ft. 5 in. deep, 4 ft. wide, cast-iron wheels, coupling chains, and hooks, at 15s.
Pair winding drums; one drum, 2 ft. 4 in. diameter; one ditto, 5 ft. 6 in. diameter; wrought-iron shafts, pedestals, and brasses; two cast-iron stands and girder; break, connecting-rod; lever on wood beam, in excellent condition, 8*l.*
— cwt. wrought-iron single-headed rails, 12 ft. and 15 ft. long, 2 in. wide, 2 in. deep, at 5s. 4d. per cwt.
— cwt. cast-iron chairs and bolts, at 3s. per cwt.
Pair winding-drums; one drum 2 ft. 4 in. diameter; one ditto, 5 ft. 6 in. diameter; wrought-iron shafts, pedestals, and brasses; two cast-iron stands and girders; break, connecting-rod; lever, on wood beam, in good condition, 7*l.* 5s.
9-ft. cast-iron water-pipe, 12 in. diameter, at 2s. 8d. per cwt.
Fly-wheel, 4 ft. 9 in. diameter, 8s.
Five wrought-iron wagons, each 5 ft. long, 3 ft. wide, 1 ft. 2 in. deep; four cast-iron wheels and axles, at 35s. each.
Slate-cutting machine, with cast-iron table 9 ft. 4 in. long, 5 ft. 2 in. wide, on bed 16 ft. long; circular saw 15 in. diameter, return motion, wrought-iron shaft and worm; two pulleys, 2 ft. 5 in. by 4 in.; cast-iron stand, pedestals, and brasses, 24*l.*
One ditto, with cast-iron table 11 ft. long, 5 ft. wide; bed, 18 ft. long; circular saw, 17 in. diameter; wrought-iron shaft, fast and loose pulleys, spur-wheel, pedestals, and brasses—by Owen, Portmadoc, 24*l.*
Slate-dressing machine, cylinder 3 ft. 4 in. wide, 2 ft. 6 in. diameter; wrought-iron shaft; fly-wheel, 4 ft. 4 in. diameter; two pulleys, 2 ft. 5 in. diameter, 4 in. face; pedestals and brasses, on wood frame—by J. W. Greaves (nearly new), 6*l.*
16-in. stroke saw-sharpening machine, on iron bed, 3 ft. 3 in. long; fast and loose pulleys (will sharpen at each end), 2*l.* 6s.
35-horse power turbine, two inlets, suction-pipe, horizontal shaft and stuffing-boxes, hand regulating guide, wrought-iron shaft and pinion, pedestals and brasses, on stone foundation—by G. Low, in good condition, 34*l.*
One spur-wheel, 4 ft. 6 in. diameter, 7 in. face, 2¾ in. pitch; one ditto, 7½ ft. diameter, 5 in. face, 1½ in. pitch, two pedestals and brasses, 4*l.* 5s.
58 ft. cast-iron line shaft, 5 in. and 4½ in. diameter; one spur-wheel, 8 ft. diameter, 7 in. face, 2¾ in. pitch; four split pulleys, each 2 ft. 9 in. diameter, 4 in. face; one ditto, 2 ft. 3 in. diameter, 8 in. face; two wood drums, 2 ft. 4 in. diam., 12 in. face; five coupling-boxes, nine pedestals, and brasses, at 4s. 1d. per cwt.
16 ft. cast-iron shaft, 4½ in. diameter, coupling-box (not fixed), 1*l.* 5s.
Crab barrel, 2 ft. 4 in. wide, 8 in. diameter, and spur-wheel, 6s.
Grindstone, 17 in. by 3 in., in wood trough, 5s.
Pair winding-drums; one drum 2 ft. 4 in. diameter, one ditto 5 ft. 6 in. diameter; wrought-iron shafts, pedestals, and brasses; two cast-iron stands and girder; break, connecting-rod; lever on wood beam and stone foundation, 6*l.* 15s.
— cwt. wrought-iron single-headed rails (various), crossings, and levers (on No. 5 level), at 5s. 5d. per cwt.
One timber wagon, with box, 18s.
— cwt. wrought-iron (flat), at 5s. 9d. per cwt.
One and two sheaved blocks and rope, 6s.
Two and a half casks of blasting powder, at 10s. per cwt.
Ten circular-saws, 19 in. diameter (new), at 3s. 6d. each.
— cwt. wrought-iron single-headed rails, 12 ft. and 15 ft. long, 2 in. wide, 2 in. deep, at 5s. 5d. per cwt.
— cwt. cast-iron chairs and bolts, at 3s. 6d. per cwt.
Nine wrought-iron wagons, each 5 ft. long, 3 ft. wide, and 1 ft. 2 in. deep (no wheels), at 23s. each.
824 oak and deal sleepers, from machine-shop to quarry, at 4d. per dozen.

The weather was favourable, and there was a good company. Considering the difficulty of removing the lots, owing to the great height of most of them, the prices obtained for the whole of the 90 lots were very high—all of them having to be removed at the expense of the purchaser. An enterprising hotel keeper from Portmadoc had provided refreshments at the foot of the mountain, and did a good trade.

The sale was conducted by Mr. H. PRICE in his usual happy style, and it was in a great measure owing to his exertions that such good results were procured.

ON BURNT IRON AND BURNT STEEL.—Mr. W. M. Williams, in a paper at the Chemical Society, said:—Iron which has been damaged by re-heating, or excessively heated and exposed after balling in the puddling furnace, is designated "burnt iron" by the workmen. Burnt iron is brittle, its fracture is short, and what is called crystalline; it has lost the fibrous character of good iron. If steel is raised to a bright red heat and suddenly cooled, it is rendered hard and brittle, but these conditions may be modified by the process of tempering. If, however, the steel be raised to a yellow or white heat, and then be suddenly cooled, it is no longer capable of being tempered by mere re-heating. The fracture of burnt steel presents a coarse grain and a crystalline appearance. Careful investigation, however, shows something more—that the facets of the aggregated granules have a more or less conchoidal form. The name of "toads' eyes" has been given by practical men to these concavities. Mr. Williams found that a piece of burnt iron contained oxide of iron dispersed through its mass. A sample of burnt steel, however, investigated in the same manner as the iron, showed no indications of the presence of oxide. In the case of steel the burning is limited to the oxidation and consequent removal of the carbon, which takes place even at a low red heat. The "toads'-eyes," or conchoidal facets, of the so-called crystals, Mr. Williams explains by supposing a piece of steel, at the temperature most favourable to the rapidest endosmosis of oxygen and the exosmosis of carbonic oxide, to be suddenly cooled, and the possible occlusion of the carbonic oxide to be arrested; the result would be a certain molecular disintegration and porosity of the spots presenting those conchoidal spots.

THE GEOLOGY OF CAMBRIDGE.

The members of the Geologists' Association made an interesting excursion to Cambridge on April 10, for the purpose of inspecting the Woodwardian Museum, and the exposure of cretaceous strata in the neighbourhood. On arriving at Cambridge the party proceeded at once to the Woodwardian Museum, where they were met by the Rev. Dr. Cookson, Master of St. Peter's College, the Rev. Thomas Wiltshire, M.A., President of the Association, Prof. Morris, the Rev. Mr. Bonney, M.A., Fellow of St. John's College, the Rev. Osmond Fisher, M.A., and Mr. Harry Seeley, F.G.S., as the representative of the venerable Prof. Sedgwick, who, much to his regret, was prevented being present. The fine collection of fossil mollusca from the district was ably described by the Rev. Mr. Bonney, and the reptilian remains were the subject of an interesting discourse by Mr. Harry Seeley, after which Prof. Morris, in the Geological Lecture Theatre, delivered an address on the geology of the country around Cambridge, which was listened to with great attention and interest by a large audience. The geological structure of the country around Cambridge is, he remarked, somewhat interesting, both in regard to its influence on the physical features of the district, as well as to the economical substances obtained therefrom. The formations chiefly belong to the Cretaceous and Upper and Middle Oolites, here and there covered by the later Pleistocene deposits. In descending order we find—

MODERN DEPOSITS..	River alluvium and fen-land.
PLEISTOCENE.....	Valley gravels and clays, with mammalian remains.
	Higher gravels, with flint and other rocks.
	Brown or boulder clay, with chalk and various other rocks.
CRETACEOUS	Lower chalk and chalk marl.
	Upper green sand. *Coprolite* bed.
	Gault.
	Lower green sand. *Coprolite* bed.
OOLITIC	Kimeridge clay.
	Upware limestone.
	Ampthill, or Tetworth clay.
	Elsworth rock.
	Oxford clay.

The fen-lands, so well known in the Eastern Counties, commence near Cambridge, on the galt, and further eastward are underlain by the Kimeridge and Oxford clays. The valley gravels bordering the Cam appear to be ancient river deposits, consisting of the re-arranged materials of the older gravels and boulder clay, and contain many land and river shells now living in the district, with two species (*unio litoralis Cyrena fluminalis*), extinct in Britain, and associated with remains of elephant, rhinoceros, bos, horse, &c. The higher gravels and boulder clay containing fragments of rocks brought from various distances indicate they have been drifted by currents of water or the action of ice, and hence are referred to the glacial period. The lower chalk, with its characteristic fossils, is only seen near Cambridge, the upper chalk forming the escarpment of the hills considerably to the east of Cambridge. The upper green sand, although of limited thickness, is well exposed from the numerous workings for phosphatic nodules, and besides which has yielded such a fine series of fossils, which are now exposed in the Woodwardian Museum—many species of reptiles (30 or 40), enaliosaurs, pterodactyles, crocodilians, dinosaurs, many fish (20 or 30), many bivalves, gasteropods, cephalopods; many crustacea, and numerous sponges, corals, foraminifera. The reptiles, especially the Ornithosauria, have been elaborately described by Mr. Harry Seeley. The galt or Cambridge brick-earth, extends over a wide area, and is well seen at Barnwell, about 150 feet thick, contains but few fossils, the *Belemnites minimus*, being sometimes abundant; the lower green sand exposed at Upware, and also reached in deep sinkings below the town (being the source of the artesian well water supply), is also worked at Upware for phosphatic nodules, but contains many fossils, chiefly Brachiopods, teeth of fishes, Sphœrodus, Gyrodus, and bones of reptiles *Iguanodon*, these latter genera being derived from some older deposits, for at Potton, Bedfordshire, the Iguanodon remains are very abundant in a deposit of similar age. The Kimeridge clay, well seen at Ely, underlies the lower green sand, which latter deposit, however, is also unconformable to other formations in its range southwards and eastwards; this clay contains many fossils, remains of the Plesiosaur and Pliosaur, and the usual characteristic shells, Ostrea deltoidea, Am. biplex, &c. The underlying strata of the Upware limestone, Ampthill clay and Elsworth rock, may possibly represent the coralian formation of other districts, although Mr. H. Seeley sees good reasons from their fossil contents to consider the Ampthill clay *only* as the true representative of the coral rag. The Oxford clay forming the great area of the fen-land, is the lowest deposit seen within a limited distance, near Cambridge, as at St. Neots, Huntingdon, &c., and contains many fossils. Besides the physical features and economical substances, the geological structure is favourable for a good water supply, from springs above the chalk marl, from those rising above the gault, from superficial gravels above the gault, and from the Artesian wells from the sands between the gault and Kimeridge clay.

The afternoon was devoted to a visit to the coprolite workings and other excavations at Barnwell. Proceeding along the banks of the Cam, a fine section of Pleistocene deposits, yielding mammalian remains, and the usual species of mollusca, was examined. This exposure exhibits some beautiful examples of false bedding, and many granite and other boulders from the drift were seen. A very extensive excavation in the gault, capped by a thin deposit of upper greensand and chalk, was next visited. The gault, excavated for brick-making, is exposed to a depth of 70 or 80 ft.; and from the evidence of well-sinkers it is here, probably, from 150 to 200 ft. thick. Fossils are rarely met with in the gault clay at this place, though in other localities this formation is very fossiliferous. Lying on the gault, at its junction with the upper greensand beds before mentioned, occurs the stratum containing the phosphatic nodules or coprolites, for which this locality is famous, and which were first noticed as being valuable for agricultural purposes by the late Prof. Henslow. At a short distance from this excavation the coprolite workings are found on all sides; indeed, the whole of the land is here being systematically explored for these valuable nodules, which lie at an average depth of 6 or 7 feet from the surface. One field after another is taken in hand; the coprolite bed of about 12 in. in thickness is taken out; the soil is carefully replaced on the surface, and the field is then again ready for tillage. The so-called coprolites are washed by horse-power, to remove the sand and loam in which they are embedded, and then they are ready for conversion into manure. A considerable number of fossils, chiefly brachiopods (Terebratula biplicata being most abundant), were obtained. The party returned to Cambridge, and in the evening were most hospitably entertained at St. John's College, by the Rev. Mr. Bonney, M.A., Fellow and tutor of the College.

On the following day, Upware, between Cambridge and Ely, was visited. At this place, situated in the fens, and near to the River Cam, very interesting sections have been exposed, in consequence of the search for coprolites. The gault, which here becomes very thin, has been cut through, and lower greensand strata reached. At the base, as at the top, of the gault, curiously enough, a bed abounding in coprolites is found, and this bed contains characteristic lower greensand fossils, together with several new species of brachiopods, described by J. F. Walker, B.A., F.G.S. Cropping out within a very short distance from this exposure of gault and lower greensand is a remarkable rock, full of fossil corals, which has hitherto been called coral rag, but which Mr. Harry Seeley, who has devoted great attention to the strata of this district, considers to be of Kimeridgian age. This rock, to which Mr. Seeley has given the name of Upware Limestone, is underlain by Ampthill clay, which would appear to be the equivalent of the coral rag of Oxfordshire, Wiltshire, Dorsetshire, &c. The brachiopods in the infra-gault coprolitic bed are abundant, especially Terebratula sella, T. prælonga and Waldheimia, or Terebratella Davidsoni, many fine specimens of each of which species were obtained, as well as numerous teeth of fishes and reptiles.

The drive back to Cambridge—twelve miles through the fens—was quickly and agreeably accomplished; and the party returned to London highly gratified with their visit to the county.

During May the Association will visit Oxford, Grays in Essex, and Yeovil in Somersetshire.

IRON AND HEAT.—A very useful and thoroughly practical little volume,* presenting in simple form the fundamental principles concerned in the construction of iron beams, pillars, and bridge girders, has been added to our metallurgical literature by Mr. J. ARMOUR, C.E., of Gateshead. As the book is intended for workmen and those immediately connected with them, rather than for those who have studied principles systematically, common arithmetic is used in the treatment of the questions, so that every argument adduced will be at once comprehended by the class for whom it is intended. The mode in which Mr Armour explains the principle of the lever is excellent, and will be fully appreciated by students, since they are shown how they may obtain ocular proof of the facts stated; and from the consideration of the lever the student is gradually led to understand the effect of stress upon fibres, the mode of determining the strength of beams and girders, pillars, and of ascertaining the effects of vibration and other forces likely to come into play. In the latter part of the book the nature of iron and steel is explained, as well as the various processes of manufacture, and the chemical and physical actions involved therein, the whole of the matters treated of being dealt with in a way that cannot fail to prove very generally acceptable. The book is in every way deserving of extensive circulation amongst working men.

* "Iron and Heat: Beams, Pillars, and Iron Smelting." By JAS. ARMOUR, C.E. London: Lockwood and Co., Stationers' Hall-court.

TECHNICAL EDUCATION.—Amongst the literature published with a view to facilitate the extension of technical education "Weale's Series" have ever enjoyed a high reputation, and the additions now being made by Messrs. LOCKWOOD and Co. (the present proprietors) will render the series even more complete, and bring the information upon the several subjects down to the present time. They have now in preparation a new edition of Hann's Analytical Geometry and Conic Sections, improved and re-written by Prof. J. R. Young; an enlargement of Heather's "Mathematical Instruments," in the shape of three volumes, describing drawing and measuring, optical, and surveying and astronomical instruments respectively, and two volumes by the same author treating of Practical Plane Geometry and Projection. In connection with mechanics and mechanical engineering, in addition to Mr. Armour's Iron and Heat, which is noticed in another column of this day's Journal, volumes are announced on Power in Motion, by the same author; on the Application of Iron to Building Structures, by Mr. Francis Campin; the Workman's Manual of Engineering Drawing, by Mr. John Maxton; a Treatise on the Metallurgy of Iron, by Mr. Hilary Bauerman; and on Mining Tools, by Mr. Morgans, of Bristol. From the names and subjects, it is evident that the publishers spare no effort to secure thoroughly competent writers for each book.

TECHNICAL INSTRUCTION FOR MINERS.—The report and Transactions of the Miners' Association of Cornwall for 1870 has just been issued, and contains, in addition to the balance-sheet, councils' and lecturers' reports, and report of the general meeting, several very valuable practical papers, embracing accounts of Boiler Explosions in Cornwall, by Mr. E. B. Marten, C.E.; the Use of Haupt's improved rock-drill in Swaledale, by Sir G. M. Denys, Bart.; a new buddle, by Captain R. H. Williams, C.E.; and on the Mineral Deposits of Old Wheal Vor, by Mr. R. Hancock. There is also a good account, by Messrs. Michell, Argall, and Eudey, of an excursion of the Breage, St. Just, Redruth, and Carharrack classes to the clay and tin works of Carclaze. The report is issued to the public at 1s. per copy, and can be obtained from our office.

THE GERMAN SALT TRADE.—An interesting pamphlet, by Mr. C. REINWARTH, describing the rock salt deposits at Stassfurt, the alkali manufactures carried on there, and their importance to industry and agriculture, has just been issued through Schönfeld's publishing house in Dresden (London: D. Nutt, Strand). Stassfurt, formerly an unimportant village, with a few thousand inhabitants, and a little saltwork, with a 17 per cent. brine, and turning out about 2500 tons of kitchen salt, lies about 12¼ English miles south-west of Magdeburg. The outcropping formation is the bunten sandstein, which is here so thick that it covers with a pretty regular deposit the older formations. In the upper stratum it is characterised by a red coloured and often micaceous clay, which is sometimes interspersed with coarse grained and fine crystalline bunches of roestone (rogenstein). Not unimportant and sometimes thick deposits of red clay also appear here as a newer sediment of the bunten sandsteins, occasionally enclosing masses of dense and fibrous gypsum and anhydrite. Not far from this place the muschelkalk overlies the bunten sandstein. Separated masses of gypsum with anhydrite, which generally play an important part at the foot of the northern and southern slopes of the Harz, follow the general direction of the mountain system, and which occur especially in the immediate vicinity of the rock salt, are frequently visible at surface, and are seldom more than a few metres down. A considerable number of more or less productive brine springs appear mostly at surface. At Stassfurt itself there is through local disturbances a peculiar and anomalous upheaval of the bunten sandsteins in the neighbourhood of the gypsums, which is very interesting both at the bottom of the valley and in the fertile land above, where a sugarbeet farm has been established. The layer of the tertiary brown coal formation of inexhaustible riches in the coal fill a trough running through the entire district, and which may be traced to Westeregeln and even further. Here in the broken valleys stands out above the surface a considerable gypsum hill, with the accompanying formations, and which has been subject to the same disturbing influence as at Stassfurt. At the present time the chemical factories of Stassfurt send an enormous quantity of the different alkaline manures into the market, and in 1869 no less than 109,075 tons of potash salts, and 56,332 tons of rock salt, were produced, the net revenue of the works amounting to 244,550 thalers, and returning a profit equal to 75 per cent. upon the amount expended upon them.

WESTERN CHRONICLE OF SCIENCE.—The February, March, and April numbers of this magazine fully maintain the character which the first acquired for it. In the February number a very good article, "On the Practical Value of Scientific Knowledge," commences, which is concluded in that for April. The March number contains an interesting notice of the Wolf Rock Lighthouse, the latest constructed by the Trinity Board, on a dangerous rock about nine miles south-west of the Land's End. The Chronicle of Science embraces a large number of scientific notes bearing upon mining, metallurgy, chemistry, zoology, astronomy, and meteorology, connected with the western counties, the record of which will be duly appreciated by Cornishmen and Devonians. The magazine will form a neat little volume at the end of the year, and, being edited by Mr. J. H. Collins, the secretary of the Royal Cornwall Polytechnic Society, will be very valuable for after reference.

THE LONDON BANKS.—It is so often required to ascertain the names and position of the various London banks, credit, discount, and finance companies in the metropolis, and of the officiers, &c., connected with them, that a directory published frequently, and issued at so low a price that one does not mind throwing it aside as each new edition appears, must be invaluable. The eighteenpenny volume issued half-yearly by Mr. E. Utley, of Threadneedle-street, contains a list of the London banks, credit, discount, and finance companies, their directors, managers, and secretaries, capitals and reserve funds, dividends and bonuses, shares and transfer forms, meetings and board days, and their whereabouts, with their latest reports, and other useful information for capitalits. The present is the twelfth issue of the little directory, and the high character acquired by the earlier issues is well maintained.

PUDDLING FURNACES.—Mr. S. MEREDITH, Tipton, constructs the side and bottom plates in the ordinary manner, and underneath the bottom plates he constructs a shallow trough or vessel or both, of somewhat larger size than the bed of the furnace, the upper edge of the trough being on the same level as or a little below the upper surfaces of the bottom plates. The top edge of the trough is bevelled on its inner side, and it is made of cast-iron in two or more pieces, connected together by screws bolts and nuts. It is provided with ribs or projections for supporting the bottom plates, the ends of these bottom plates resting upon flanges or bearing plates, along the outside of which and near the top thereof is a horizontal water-pipe or tube running around the furnace. The inner side of this pipe or tube is pierced with fine holes, inclined towards the side plates. Water is supplied to the water-pipe and passes out at the small holes, and falls upon the outside of the plates, and runs down and cools them. The water from the side plates is received in the trough or both under the bed or bottom plates of the furnace. The trough is provided with an overflow pipe, opening at a level a little above the under surfaces of the bottom plates, at which level the water is maintained.

PUMPS.—The invention of Mr. G. C. BISHOP, Montreal, Canada, consists in constructing and arranging the parts of pumps for raising and forcing liquids. The body of the pump consists of a hollow cylinder situated horizontally. In the axis of the said cylinder is a shaft carrying a plate, which plate extends from the said shaft to the ends and inner cylindrical surface of the hollow cylinder, and constitutes a piston capable of being made to oscillate by the shaft. The ends of the shaft pass through the ends of the cylinder, and by means of a handle or handles an oscillating motion can be given to the said shaft and piston. The oscillating piston is provided with a valve on each side of the shaft, the valves being hinged to the piston and opening upwards. On the upper side of the pump cylinder is the egress or delivery pipe, and on the under side of the said cylinder is in the ingress or suction pipe. Within the cylinder and immediately over the suction pipe is a fixed partition, the said partition having the figure of an inverted letter V. By means of the said partition communication between the suction pipe and the delivery pipe is cut off excepting through the valves, one on each of the sides of the said V-shaped partition.

LUBRICATING OIL.—Mr. H. C. DE BLENDE, Upper Thames-street, proposes to take crude rape, olive, neatsfoot, or lard oil, or a mixture of these oils, and adds thereto bichromate of potash and sulphuric acid. He uses about 2½ per cent. of the bichromate, dissolved in about six times its weight of water, and about 1 per cent. of commercial sulphuric acid diluted with twice its weight of water. The oil should be well agitated with these materials for about four hours, they are then drawn off from it, and the remaining oil is neutralised by the addition of about 1 per cent. of chalk. Afterwards the oil is treated with about 2½ per cent. of a solution of caustic soda of a strength of 36° Beaume, and with about 1 per cent. of animal charcoal, more or less, according to the amount of colour it is desired to remove.

WHEELS.—Mr. W. FIRTH, of Edinburgh, has patented an invention, one object of which is to provide for the retrograde motion taking place easily, thereby saving driving power and rendering the tyre less liable to injury. The retrograde motion of the compressible tyre may, however, be prevented provided a contraction, or something equivalent thereto, of the uncompressed surface takes place while being compressed, for if the bearing arc or portion of the wheel face bearing the weight of the carriage at any particular instant can be reduced to the length of the segmental line or chord, or the line coinciding with

the plane of the road or rail, the circumference of the whole circle will be reduced to the length of the rolling circle of such a wheel. The prevention of the retrograde motion of these compressible tyres is the second object. The third object is to provide means for easily removing the different parts of a segmental tyre for repair and replacement, and this is accomplished by making each compressible felloe or tyre segment depend from or between one or more rods, tubes, or pins, secured to or kept between the wheel flanges, and making one or more series of such rods, tubes, or pins perform the additional function of a rigid tyre.

COAL, AND THE CHEMISTS.

Numerous as are the uses to which our coal seams are being put and immense as are the benefits whichwe derive from them, we have not got to anything like the limit of the services which the ancient forests of our planet will yet render. GEORGE STEPHENSON'S "bottled sunshine" is now being liberated to drive our locomotives and stationary engines, and to supply us with artificial light through the gas retorts, and it was only yesterday when we were rejoicing over the products of these retorts having furnished us with a new and a beautiful colour. Whatever may be the force pent up in our coal seams—and upon this Mr. ROBERT HUNT, F.R.S., discourses most interestingly in the current number of the "Popular Science Review"—the chemists have yet to furnish us with colours and colouring matter produced from coal, which will go to enrich the nation, by setting free for more productive cultivation much land now used for supplying not a few of the wants of our dyers and others. Mr. W. H. PERKIN is still giving strict attention to this very important subject, and he has arrived at a measure of success which Professor ROSCOE says marks an era in the history of the application of chemistry to the arts and manufactures even of greater importance than the memorable discovery made by Mr. PERKIN in 1856, of the production of aniline violet, or mauve. Mr. PERKIN'S recent triumph of the study of coal gas refuse is intimately connected with the previous results. He has now obtained from this refuse a new colouring matter, which has hitherto been derived from the madder plant, the *Rubia Tinctorum*, which almost from time immemorial has been the faithful and most highly prized servant of the dyer, but which the ruthless hand of science is about to displace, just as the little cochineal insect has been set aside.

Mr. PERKIN'S invention has been chattily, yet ably, discussed by a scientific correspondent of the *Birmingham Morning News*, whose several communications have supplied us with the means of furnishing what follows. The crude, treacly liquid that is distilled from common coal may be refined in the same manner as the crude paraffin tar. There are various modifications of the refining process. By one naphthaline may be produced, from which candles may be made, but their flame, instead of being of a clear, beautiful light, would have a dirty appearance, and would produce thick black smoke. The liquid products separable from naphthaline are chiefly those commonly known as naphtha and dead-oil, which is used in the naphtha lamps often seen in the open markets of the country at night time, and at pleasure fairs. The more volatile portion of the naphtha is chiefly composed of two very interesting and important liquids—benzole and toluole. These are easily separable from each other; benzole may be frozen, while the toluole remains liquid. From both these substances the most magnificent colours that the human eyes may behold are obtainable. To the philosophical chemist they have a further and a deeper interest than even that connected with this great practical triumph. Their history is connected in a most important manner with the development of the modern theoretical structure of organic chemistry. If some benzole be taken, and some nitric acid added, then we have a great commotion, much sputtering, boiling, and fuming, and finally a new oily liquid is formed, having so decidedly the flavour of bitter almonds that it is now largely used instead of the real essence of bitter almonds, for giving that flavour to custards, blancmanges, &c. This is called nitro-benzole. If this is now exposed to the action of acetic acid and iron filings, or zinc and hydrochloric acid, a further change takes place, and another oily liquid is produced. This is the aniline, from which the "marvellous aniline colours" are derived. We may use the toluole instead of the benzole, and obtain analine from it, by first converting it into nitro-toluole, and then distilling it with lime. In this case the change is effected by the removal of the elements of carbonic acid, and the conversion of the caustic lime into carbonate of lime. In the case of the nitro-benzole the change is effected by the hydrogen which is given off by the zinc, or the iron filings. Some of the hydrogen combines with the oxygen of the nitro-benzole, and takes it away as water; while another portion of the hydrogen combines with the nitro-benzole, and by these combined actions the new substance—the aniline—is formed. The commercial method of producing large quantities of magenta and other allied colours is simply to boil the analine for some hours with dry arsenic acid. The colour varies with the time and the temperature, and all the tints, from nearly blood colour to an almost pure blue, may thus be obtained.

The most difficult colour to obtain from coal is black—a true black appears to be even unattainable. While coal has thus failed to supersede the old dyes of its own hue, it has been quite successful in the opposite direction, as our white silks are now all dyed with coal tar colours. The raw silk from the worm varies from a bright orange through yellows, straw colours, and greenish-yellows to a pale lemon green, and it is found much easier to neutralise these tints by the superposition of rose and blue tints than to bleach away the original colours. The white silk of commerce is really a pale blue. This application of the aniline blue corresponds to the use of the "blue bag" by the town laundress as a substitute for the sweet old-fashioned grass-bleaching of the rustic washerwoman. The cochineal insect, which was formerly the main source of the most brilliant colours for wool and silk, is now almost driven out of the market by the competition of his unlikely rival the coal tar; but until very lately the old chief servant of the cotton and linen dyer still kept its place, the adhesion of the aniline colours to the vegetable fibre not being so satisfactory as their behaviour to silk and wool. This old servant is the *Rubia Tinctorum*—the Madder plant, the root of which has been used since the time of Hippocrates. It is a native of Europe and Asia Minor, and largely cultivated in Holland, France, and Turkey, and to a smaller extent in other countries. The root itself in its fresh state contains no useful colouring matter, but a peculiar ferment which it contains develope a powerful colouring principle that has been used for above 2000 years, but was never separated or understood until 1831, when MM. ROBIQUET and COLIN obtained it as a crystalline sublimate. Even then it received but little attention until in 1848 SCHUNCK showed that all the finest madder colours contained only this substance—*Alizarine*, combined with bases and fatty acids.

A second colouring matter, purpurine, was discovered by PERZOZ. This, however, is but subordinate to the alizarine, and only serves the purpose of modifying its tints. Alizarine was shown to be a weak acid, having but little colour in itself; but when brought into contact with basic substances, such as potash, lime, and other basic oxydes of metals, produced brilliant-coloured precipitates. These facts have been settled, and, alizarine having been analysed, the problem of producing it artificially, of course, presented itself. The first question to decide in reference to alizarine was a purely theoretical one—To what organic type does it belong? This question was worked out with great industry, and finally it was determined that it was related to anthracene and quinone, both derivable from coal tar, that anthracene was obtainable from alizarine, and, therefore, the converse was possible. The desired alizarine is now commercially prepared, and this artificial acid is far superior to the natural product, as formerly prepared for the dyer from the madder root. The dyer is now supplied with the pure alizarine instead of a mingled mess of vegetable extracts, containing only 5 or 6 per cent. of what he required. The cultivation of the madder root will soon be a business of the past, and the land which it has covered will be available for growing food or other useful articles. Further, although Mincing-lane is not yet alarmed, the day is not far distant when the merchants of the East will lose one of their rich commodities, for the colouring matter of indigo, like that of madder, has been isolated, its composition and affinities have been determined, and small quantities have actually been produced in the laboratory. This is the usual course. The new substance is first of all a chemical curiosity, then the laboratory processes are modified and adapted for large scale working, and finally mankind at large reap the harvest which grows so richly from the seed which science is ever sowing.

THE SMOKE NUISANCE.

The second report of the Royal Sanitary Commission consists of evidence taken before the Commission from November, 1869, to June, 1870; and the number of witnesses called was 34. Amongst those examined was Mr. Henry Bleckley, the ironmaster of Warrington, and a county and borough magistrate. In reply to the Commissioners, Mr. Blechley expressed his opinion that the penalties imposed by the present law were excessive; but he could not recommend that a small penalty should be inflicted upon the fireman or stoker rather than upon the master, for the stoker was a mere labourer, and it was quite impossible to get men of this class who would be upon the alert, and not prefer their own ease in throwing on shovelfuls of coals at once, instead of doing it in a minimum quantity. It was further impossible to get a skilled mechanic who would undertake such work; and it was to be observed that, no matter how the furnaces were constructed, if they were not carefully fired the penalty was inflicted upon the manufacturer, whether he was guilty or not; and, as it came to pass that those proceedings were sometimes taken months after the offence, it was quite impossible for him to say who the man was, and the manufacturer would not, therefore, be able to fine the man for it. Upon the question of health, the witness said that the injury to the public health caused by black smoke was greatly exaggerated, and he explained that the coal in Lancashire contained from 1½ to 2 per cent. of sulphur, and in the combustion of that coal there was a very large quantity—a larger quantity than anybody would probably believe—of sulphurous acid thrown into the atmosphere; yet if enquiry were made as to whether injury was done by the smoke, the whole injury which was done by the invisible gases was put to the account of black smoke; and it did appear unreasonable, he said, that the charge should be put to the account of black smoke because it happens to be seen, whereas the effect upon the vegetation, and upon the atmosphere was due probably to the invisible gases, which did much more injury. In the works with which he was connected they burnt about 2000 tons of coal in the course of five days in puddling iron, upon a space of about 10 acres of land. Every hour there were about 15 tons of coal consumed, so that it was practically impossible to prevent smoke issuing from such a quantity of coal burnt in a small space and under a small number of chimneys. Upon the same point Mr. Bleckley drew attention to the fact that there were in many cases, not provided for by the Act, in ironworks 20 or 30 furnaces turned into one chimney, observing that if one man was firing one of those furnaces there might be a very moderate amount of smoke produced, and not what would be considered a nuisance under this Act; but if that smoke were multiplied by 15, and the men happened to be firing 15 furnaces at the same time, the smoke from them all going into one chimney, it was quite impossible that the combined smoke of 15 furnaces should not present some black smoke in the atmosphere.

Reverting to the question of remedies, Mr. Bleckley said that the legislation upon this subject was regarded as a mistake; that manufacturers were dealt with as though they were enemies of society and a nuisance, to be treated with a severity which interfered with their action, and put them in the position of persons who were supposed to be breaking the law, when they had no intention or wish to do so at all. In answer to an objection that a complainant had not the same means for ascertaining whether the smoke complained of was consumable as those possessed by the defendant, he argued that he could be admitted to the works as the alkali inspector was. The alkali inspector was the man to make the complaint, and he went round the works and tested the condensation as to whether it was as required by the Act. Parliament, he urged, never contemplated that there should be 40 furnaces put into one chimney, but dealt with the question as though each furnace had a single chimney to itself. If that were done the atmosphere would be filled with a smothering sulphurous acid, and though they would, probably, not be liable to penalties under this Act, they would do infinitely more mischief than by having one chimney for 30 or 40 furnaces. He was not aware, he said, of any manufacturers constantly consuming their own smoke entirely, nor did he know that smoke had been effectually consumed in Manchester or Birmingham.

In concluding his evidence, Mr. Bleckley said there were no skilled inspectors of a superior class in his neighbourhood; and there was no referee or arbitrator to decide a dispute as to whether all reasonable means had been taken or not; and he had no doubt that it would be satisfactory to manufacturers if in such cases there were a referee, such as Dr. Angus, the Alkali Act Inspector. He mentioned that where there was a high uniform temperature there need be no nuisance at all; and that, although the utmost pains were taken, there were times when, in some manufactures, black smoke must be issuing; and he also explained that while the Inspectors under the Alkali Act were appointed by Government, those under the Smoke Act were appointed by guardians and by the corporations in municipal boroughs.

FURNACES AND FIRE-CLAYS.

The constant necessity for employing, in almost every branch of industry, furnaces capable of withstanding a high temperature causes almost as much importance to attach to the question of the supply of first-class fire-bricks as to the supply of fuel itself; and, as really reliable fire-brick is by no means easy to obtain, those who are fortunate enough to possess a deposit of the clay of the exact composition which gives it its most refractory properties can not only command an extensive market at all times, but can also ensure such prices as to leave a very large margin for profit. It is to this circumstance that may be attributed the fact that the proprietors of all the better known fire-clay and fire-brick works are amongst the prosperous of those connected with the utilisation of our mineral resources. But the value of a fire-clay depends entirely upon the degree in which it possesses the refractory quality, and the difference in this respect of the various clays met with in different districts, and even in different localities in the same district, is enormous. A good fire-brick should not melt nor soften in a sensible degree by exposure to intense heat, long and uninterruptedly continued; it should resist sudden and great extremes of heat, should support considerable pressure at high temperatures without crumbling, and in many cases is required to resist the corrosive action of various substances melted in contact with it.

It is the difficulty of producing a brick fulfilling all these conditions that gives the first-class fire-bricks so extensive a market at good prices. The highly refractory quality of the Stourbridge bricks has secured for them a marvellous reputation, and they have been exported to various parts of the world, even far remote. All the best fire-bricks have a pale brownish yellow colour, and are usually spotted throughout with brownish black, due, it is believed, to the existence of particles of iron pyrites diffused through the clay. But it must not be supposed that Stourbridge is the only place where the first-class fire-bricks can be obtained. At Beleu, in the Ardennes, for example, a clay is obtained so refractory that at the highest temperature of the Sevres porcelain kiln it only frits on the surface; and Brongniart mentions the clays of Mouchy, St. Eloy (Oise), of Septveille, near Provins, and of St. Vallier, near Oriol, which were exposed to the highest temperature of a porcelain furnace, yet (being protected from the direct action of the potash contained in the ashes, wood being the fuel) they suffered no change. It now appears that at Hingston Down, Cornwall, a deposit of fire-clay exists which is at least equal to the best of the French clays, for Messrs. C. W. Siemens and Co. report that the bricks made from it will stand any amount of heat, and will do for any kind of smelting; they could not melt them without destroying the furnace. They consider "they will stand twenty times the heat that the Stourbridge bricks will," and would thus appear to be more like the best French bricks than even the Stourbridge, for in the comparative tests that Brongniart made between the Stourbridge bricks and those already alluded to, he found that although the French bricks suffered no change, Stourbridge bricks exposed to exactly the same conditions became red-brown, and completely softened.

That so valuable a deposit as that at Hingston Down may not be permitted to remain unworked, a company, under the title of the TAMAR FIRE-BRICK AND CLAY COMPANY, with a capital of 20,000*l.*, in shares of 2*l.* each, has been formed, and, as will be seen from the prospectus, which appears in another column, there are unusual prospects of very satisfactory profits being realised. A careful analysis of the clay, made by Dr. H. M. Noad, F.R.S., shows the composition of it to correspond very closely with that of the best Stourbridge clay; and, judging from the report of Messrs. Siemens, the difference is decidedly in favour of the Tamar clay, so that it may reasonably be anticipated that the Tamar clay will speedily come largely into the market. It is found in the exact proportions perfectly blended, and ready for use, rendering a great amount of labour and cost in mixing and grinding unnecessary; and as the shipping port is in close proximity to the works, the company will be enabled to sell considerably below the price at present paid for the Stourbridge ware, and still leave a very large percentage of profit upon their entire capital.

STEAM BOILER EXPLOSIONS.

The Select Committee of the House of Commons on this subject resumed its sittings on Tuesday,—Mr. FLICK, M.P., in the chair.

Mr. WOLLASTON BLAKE, C.E. (of the firm of Watt and Co., Birmingham, and member of the Institute of Civil Engineers), was first examined. On the question of the necessity of the compulsory examinated of boilers, he stated his general view of the matter to be that, looking at the enormous interests at stake, it appeared to him that the trades connected with boilers were singularly safe. The average of explosions, 50 per year, represented one in 2000, and that for any trade, particularly one that involved dealing with steam, showed it to be safe. He thought compulsory inspection would be extremely difficult to carry out. It was in evidence that the saving that might be gained was about one in 4000, which would be an exceedingly small return for the large amount of money expended. Besides, cases of carelessness must be deducted. The examination would, moreover, take away responsibility from the user. Inspection during boiler making, he cousidered, would cause endless disputes. Looking at the expenses involved in inspection, and the average small margin got by it, his opinion was that it would not be worth while carrying out. He should suggest that in every case of explosion a very careful enquiry should be made by the Board of Trade, and by independent engineers. Every boiler should receive a certificate from the maker that it has been proved, and was fit to work at such a pressure. The voluntary inspection carried out by the Steam Users' Association was, he thought, desirable, and should be extended. Besides questioning very much whether compulsory examination would prevent explosions, for many reasons he was also altogether against it.

Mr. RAVENHILL, C.E., agreed with the last witness, that compulsory inspection would be difficult to carry out. It would be also liable to affect the progress of engineering science, and would relieve owners of responsibility. He did not think inspectors would be of any use unless they could get at the small boilers, which he did not think possible.

Mr. BLYTH, C.E., thought that proper inspection would save a great number of lives. He was not in favour of compulsory inspection, but thought Lord Campbell's Act should be more generally carried out.

Mr. WIGRAM, who was engaged with a firm of agricultural engineers, said some agricultural engine boilers went without any examination for four or five years. They might go without danger for that period, although the time must arrive when it would become necessary.

Mr. ANDERSON, boiler maker, suggested making coroners' inquests more stringent. The coroner should be assisted by assessors, who, in the event of a jury giving a verdict against evidence, should report to the Home Secretary, in order to institute proceedings against the delinquents. The fear of punishment would, in his opinion, cause all reasonable precaution to be taken.

Mr. MURRAY, engineer (in partnership with Sir Wm. Fairbairn), expressed himself in favour of compulsory inspection, the users being, however, left at liberty to choose their own inspectors. An Act, specifying various fittings to be used for different classes of boilers, would be useful in preventing explosions.

The committee then adjourned.

NEW PUMP, FOR RAISING WATER.

THE GREAT PUMP.—The feature of the week, in mechanical circles at least, has been the exhibition of the marvel of mechanism above mentioned. At the Bridesburg Manufacturing Company's works an exhibition of this pump was made, which satisfied all who witnessed it of the superiority, economy, and great merit of this wonderful machine. The pump consists of a cast-iron pipe 8 in. in diameter, and of any length demanded by the situation to which it is to be applied, the pipe being cast in sections of 6 ft. in length, and bolted together. In the intervals between these sections are shorter sections of 1 ft. in length, constructed in the same manner, with bearings supporting a steel shaft, 1¾ in. in diameter, and extending the entire interior length of the pipe. Attached to this shaft, at intervals of 3 ft., are screw propellers, with two blades, 7½ in. in diameter, with an angular pitch of 65°, and revolving with the shaft. Attached to the sides of the pipe, and half-way between the propellers, are wings or blades, of the same form and pitch as the propellers, but at a reversed angle. The bottom of the pipe is inclosed in a basket, to prevent stones or sticks from being drawn up. At the top a novel and ingenious arrangement supports the shaft and the column of water. The successful management of this caused considerable delay in perfecting the pump, but all obstacles are now happily overcome. To the top of the pipe is fastened a disc, upon which rests a ring of brass 12 in. in diameter, and on the top of this another disc, 14 in. in diameter, and embracing the outer periphery of the brass ring. The upper disc is permanently fastened to the propeller shaft. Water is forced by a small donkey pump between the two discs, under a pressure sufficient to slightly separate them, so that the top disc, propeller shaft, and column of water are supported by the film of water between the discs, the rotation of the propeller shaft in the water consequently causing but little friction. Any surplus water forced in by the donkey pump between the discs raises the brass ring and escapes. The propeller shaft is run by a wire-rope passing around a grooved pulley in the upper disc, and connected with a steam-engine. Such is the description of the most simple and practical pump yet invented. No valves, no wearing parts, no costly appendages, and enormous power.

OPERATION.—Upon starting the engine, the revolving shaft produces a continuous and solid stream of water from the pipe of 8 in. diameter and 1¾ in. shaft, of 1700 gallons per minute. The propellers lift the water to the stationary wings, where it is sustained until the next propeller carries it on, and out of the pipe ultimately, thus avoiding all valve movement. The above shows the product of an 8-inch pump, but the operations of the machine in increased diameters is equally efficacious. A pump of 20 in. diameter was shown in operation, with, of course, similar proportions of shaft, propellers, &c., which was truly marvellous in execution. The power-pulley was 18 in. diameter, with a 10-in. belt, making 500 revolutions per minute, driven by an engine of 22-horse power. This produced a flow of water 101 in. wide and 5½ in. deep. An indicator attached, consisting of a small toothed disc, with 160 teeth, and revolving once in two minutes and-a-half, noted the velocity of the water as *ten thousand and ninety-eight gallons* per minute.

ADVANTAGES.—The advantages of this pump are great, and may be briefly noted as follows:—Simplicity: In consisting of but three pieces—pipe, shaft, and propeller, and with no valves. Economy: The cost being much less than any pump of equal power. Power: An 8-in. pump, lifting 1700 gallons per minute, to a height of 300 ft., while a 20-in. pipe gives 10,000 gallons per minute. Absence of Friction: Sustaining a heavy column of water at any desired height. Capability: As it can be used either as a lift or force pump. Self-Lubricating: Requiring no oil.

For our coal and gold and silver mines, where the pressure of water is the great obstacle to success, this pump cannot fail to be invaluable, as also for supplying cities with water at much less expense than that of the present system. It is the invention of Mr. Shaw, and manufactured by the Bridesburg Manufacturing Company, of which Colonel Burton H. Jenks, the President, is himself an inventor of some note, and has contributed greatly to the success of this affair. As a Philadelphia invention and manufacture we give it especial notice, entitled as it surely is, by its great merit and simplicity, to the attention of all interested in the subject.—*The Iron Age* (*U. S.*)

IMPROVED STAMPS.—The difficulties attending the transport of machinery to mines in unsettled countries, far from shipping ports, renders it essential that every portion of a machine intended to be used under such circumstances should be made sufficiently light to permit of its ready carriage on mule-back. In the construction of stamping-machinery for difficult countries, considerable inconvenience has always been experienced in obtaining the requisite force of blow without introducing such weights as to be objectionable. To remove the obstacle, Mr. JOHN WALKER, of James-street, City-road, whose reputation as a colonial engineer is already well known to the readers of the *Mining Journal*, has invented a mode of augmenting the force of the blow by a very simple arrangement for increasing the fall of the stamps-head. The essential feature of the improvement is the introduction of lifters on both sides of the stamps-rods, which lifters act in pairs, so that the lift and fall of the rod is always absolutely perpendicular to the bed. By this means friction is reduced to the minimum, and as the head makes a portion of a revolution each fall, and falls from 15 to 20 times in one minute, the wear is always perfectly even, and the durability is much increased. The facility for lifting is also so much greater with the new arrangement that three or four heads of a battery can readily be worked by hand whenever, for aiding prospecting operations, it is desirable to do so; yet as soon as permanent working is decided upon, it would simply be requisite to remove the handles, and apply the power by means of a band, in order to possess all the advantages of stamps of much larger size of the usual construction.

LONDON GENERAL OMNIBUS COMPANY.—The traffic receipts for the week ending April 16 were 10,355*l.* 10*s.* 11*d.*

FOREIGN MINING AND METALLURGY.

Advices from Dortmund state that the rise in the price of rough iron and other metallurgical products which had been noticed before the war, continued all through the prevalence of hostilities, as well in consequence of the high price of coal as of the scarcity of workmen. It is expected, however, that a fall in quotations will follow promptly on the definitive conclusion of peace; at the same time, it is not thought that prices will descend to the same level as formerly. As regards France, German industrials expect to see England and France temporarily "dominate" the markets of those countries. German industry will find, on the other hand, important outlets in the Zollverein. The resumption of railway works must decidedly stimulate the activity of the metallurgical establishments and rolling-mills, especially in the Rhenish provinces and in Westphalia, where the realisation of several great railway projects is now being attempted. The Cologne and Minden Railway Company proposes to construct a line from Venloo to Hamburg, as well as the line styled the Emscher-thalbahn; the Berg and Mark Railway Company will establish a line *via* the valley of the Ruhr, running from Welkenraedt to Aix-la-Chapelle, a line from Cologne to Gladbach, and a number of small sections. The Rhenish Railway Company proposes to lay down a second set of metals on several of its sections. All these works and extensions will necessarily absorb considerable quantities of rails.

The continuance of the civil war in France has proved more and more injurious to the Belgian coal trade. The export demand is ordinarily the chief resource of Belgian coalowners at this season of the year, when domestic consumption in a great measure makes default; and the industrial demand, although larger than usual, does not compensate for the closing in great part of the foreign market. Moreover, the Belgian industrial establishments are just now amply supplied with coal, since when the civil war broke out among the French coal which had been intended for France was sent instead to Belgian works. Although the deliveries of Belgian coal are for the present restricted, there are, strangely enough, considerable complaints as to scarcity of rolling stock. This singular state of things must arise from defective organisation, and a want of a proper understanding among the railway companies. Thus, it is stated that although the Northern of France Railway possesses thousands of unoccupied trucks, Northern of France trucks cannot be obtained; under present circumstances, however, the management of the Northern of France is probably chary in parting with the company's rolling stock. It appears that in January coal was imported into Belgium to the extent of 9483 tons, against 21,237 tons in January, 1870; coke was also imported to the extent of 94 tons, as compared with 954 tons in January, 1870. The exports of coal from Belgium amounted in January to only 73,315 tons, against 348,176 tons in January, 1870. Of coke the exports in January were 26,381 tons, against 61,314 tons in January, 1870. These totals show clearly enough the deplorable condition to which the Belgian coal trade was reduced by the war.

The condition of the Belgian iron trade is considered to be sensibly better than that of the Belgian coal trade; Belgian ironmasters are, in fact, profiting largely from the trials which French and German industrials have to sustain. Orders are numerous for all descriptions of iron, and the various establishments are largely supplied with work. MM. de Dorlodot Frères, of Acoz, have, for instance, work on hand for six months in advance; they are negociating besides for considerable contracts. It appears that the imports of iron minerals into Belgium in January were only 28,591 tons, against 47,105 tons in January, 1870. Of rough pig and old iron the imports of January were only 2285 tons, against 7006 tons. Iron of every description was imported in January to the extent of 2625 tons, against 8134 tons in the corresponding month of 1870. The exports of iron minerals from Belgium in January amounted to 8541 tons, against 12,130 tons in January, 1870; of rough pig and old iron the exports were 487 tons in January, against 712 tons in January, 1870. The exports of rails from Belgium experienced a notable diminution in January, having been 215 tons only, against 7753 tons in January, 1870. Of plates, the exports in January were only 476 tons, against 1453 tons in January, 1870; of other descriptions of iron the exports also declined in January to 1742 tons, against 6126 tons in January, 1870. The aggregate exports of iron of every description other than minerals amounted in January to 3667 tons, against 17,646 tons in January, 1870. The annexed table shows in detail the exports of all descriptions of iron from Belgium in Jan., 1871, and Jan. 1870:—

Direction of export.	January, 1871.	January, 1870.
Russia	Tons —	Tons 1101
Denmark	2	1
Zollverein	2101	5344
Hanse Towns	69	273
Low Countries	856	1186
England	156	740
France	305	2291
Spain	78	32
Italy	—	2165
Switzerland	—	595
Austria	63	601
Roman States	—	35
Turkey	2	1386
Egypt	—	3
United States	—	1710
Cuba and Porto Rico	—	278
Uruguay	3	—
Brazil	—	11
Rio de la Plata	32	4
Total	3667	17,646

It must be admitted that the new year did not open very well for Belgian metallurgy, so far as its foreign relations were concerned.

At Marseilles, Toka copper has been quoted at 72*l.*, Spanish at 70*l.*, and refined Chilian and Peruvian 72*l.* per ton. At Havre, Chilian in bars has remained neglected; current disposeable marks have made about 66*l.* per ton. The German copper markets have presented no very special characteristics. It is remarked, however, that transports begin to be made with greater regularity, while the amount of available labour is every day increasing. For the present business in copper is quiet, but prices are supported with firmness. In Holland copper does not appear to have experienced much change. Tin has acquired a good tone in Germany, in consequence of the firmness of the producing markets. In Holland the article was firm last week, but business did not present much importance; Banca was dealt in at 76 fls. to 76½ fls., and at this latter price there were sellers. Lead in saumons, first fusion, has been dealt in at Marseilles at 18*l.* per ton; ditto, second fusion, 17*l.* 12*s.*; ditto in shot, 21*l.* 4*s.*; rolled and in pipes, 21*l.* per ton. In Germany the tone of the article has been satisfactory. In Holland, Stolberg and Eschweiler lead have made 11 fls., and German lead of various marks 10¾ fls. Zinc has been quiet, and shows scarcely any upward tendency.

MINING IN CANADA.

[Concluded from the Supplement to the Mining Journal of April 8.]

PYRITES.—About 460 tons of this mineral was mined at the large deposit in the township of Elizabethtown, about three miles west of Brockville, for the use of the Brockville Chemical Works. In October last 50 tons of pyrites was taken from a deposit on lot 20, in the 3rd concession of the Township of Dalhousie, and shipped by way of Perth. The Lynn magnetic pyrites mine, belonging to Mr. J. Bell, of Perth, has not been worked during the year.

MINERAL PHOSPHATE.—Messrs. Cowan and Robinson have mined 400 tons of apatite in the township of Burgess during the summer, and have sent it to their chemical works in Brockville, where 360 tons were converted into superphosphate of lime. This manure is worth $40 a ton at the works. The greater part of it was sent to the United States, where it commands a ready sale. A small quantity only was sold in Ontario and Quebec, where its value is not yet sufficiently appreciated, and about 40 tons were sent to England. Two beds of apatite were opened by Mr. Samuel Poole, in the south-west corner of the Township of South Crosby, last autumn, and 100 tons of the mineral taken out. Several gentlemen from England have visited the deposits of mineral phosphate in Elmsley, and other places in the neighbourhood of Perth, and are said to have made arrangements for mining them extensively during the present year.

GYPSUM.—This mineral continues to be worked at various points along the Grand River, all the way from Paris to Dunnville, but we have not the date for estimating the whole amount produced during the year. Mr. A. Taylor raised about 3300 tons at York, and Mr. John Brown, of Thorold, about 1700 at the Grand River Plaster Beds, near Dunnville. This mineral, being obtained conveniently at many places in the Western States and in the maritime provinces, is sent across Lake Erie and Ontario into Upper Canada, and brought up the St. Lawrence to supply the provinces of Quebec. In Montreal, 1500 tons of Nova Scotia plaster were ground last year by Mr. John A. Converse, and about 1600 tons by Messrs. Lymans, Clare, and Co. There is also a plaster mill at Quebec, supplied with the raw material from the lower provinces.

SALT.—Brine was accidentally discovered at Goderich, in 1866, while boring a well in search of petroleum. Since that time a number of wells have been sunk, and the manufacture of salt has increased steadily, in spite of many difficulties. The average depth of the wells, ten of which are now in operation, is from 1000 to 1100 ft. Some of these wells penetrate solid rock salt, and the brine in all of them is of the purest kind, and of great strength. At first the evaporation was carried on by means of kettles only, but now pans are largely used, and found to be better adapted to the strong brine of the Goderich wells. Salt we is are also in operation at Clinton, Seaforth, and Kincardine. Were it not for the enormous duty on salt imported into the United States, amounting to 24 cents per 100 lbs. if in packages, and 18 cents if in bulk, the salt business of Goderich would be very much greater than it is at the present time. Our own Government, at the last session of the House of Commons, made a concession to the Canadian salt producers, by imposing a duty of 25 cents per barrel of 280 lbs. on salt imported from the United States. The effect of this has been a great reduction of the imports, and a corresponding increase in the home production. As nearly as we can determine, the latter has amounted to about 175,000 barrels for the year.

PETROLEUM.—The production of petroleum in the township of Enniskillen, Ont., has increased considerably, averaging during the first few months between 3000 and 4000 barrels per week, and towards the close of the year between 6000 and 7000 barrels, of 40 gallons each, so that the total production has probably been in the neighbourhood 250,000 barrels, or 10,000,000 of gallons. About one-half of this appears to have been exported. The exports of petroleum from the United States for 1870 have amounted to about 140,000,000 of gallons, exceeding in value the exports of flour. The price of crude oil at the Canadian wells has ranged from $1·25 to $1·25 per barrel, while that of refined has been about 20 cents per gallon. Much of the refining is done at London, from which town, according to the returns of the Inland Revenue Department, 1,330,029 gallons were shipped during the year. The boring of new wells has been actively prosecuted. It would be impossible in our limited space to give the details of these operations, but their result has been to extend considerably the limits of the oil-producing territory around Petrolia, and to show that as good wells are being struck now as at any period in the history of this region.

SLATE.—The Rockland Quarry, seven miles south-east of Melbourne village, has been worked during the whole year, with an average of about 30 men. The depth of the quarry is now over 80 ft., and the quality of the slate continues to improve, and is considered equal to any in the world. The slates are dressed by small machines, which are found to be a great improvement on the old methods of hand-dressing. At the Melbourne Quarry, which is three or four miles south of the village of the same name, the steam dressing machines have fallen into disuse, and the slates are again dressed by hand. About 25 men are employed. The company have been preparing the quarry for more extended and systematic working, so that the production of the year has not been equal to that of 1869. The united production of these two quarries will not exceed 5000 squares for the year. Some of the old proprietors of the Granby Red Slate Quarry have paid off its liabilities, and are about to resume operations. The slate of this quarry has been found very suitable for manufacture of jambs and mantles, and a considerable number were marbleised and sold in the province a year or two ago. The Danville School Slate Quarry has changed hands, and only a limited amount of work is being done. The slates from this quarry have been introduced into the market by Mr. Robert Miller, of Montreal, and found to be well adapted for school purposes.

PEAT.—The largest business has been done by the Canada Peat Fuel Company. During the summer months they have employed at their three bogs at Lapigeonniere, St. Hubert, and St. Brigide, about 600 hands, and produced 16,000 tons of peat, worth $3 a ton on the ground. The peat is used by the Grand Trunk Railway, and is coming into favour for domestic use in Montreal. The Champlain Bog, worked by Mr. R. Graham, of Montreal, has supplied a largely increased quantity of fuel to the Montreal market. The Valleyfield Peat Coal Company, besides making extensive preparations for the manufacture of solid peat in the coming summer, produced and sold a quantity of fuel last season. Peat is worked to a small extent near Vaudreuil, St. Ours, Fern's Point, and Riviere Ouelle. Almost inexhaustible supplies of this fuel exist in various parts of Quebec and the maritime provinces, and they will in future be turned to valuable account when our forests shall have been exhausted. There is a peat bog in Anticosti which is believed to have a greater area than the largest bog in Ireland.

MINING IN AUSTRALASIA—MONTHLY SUMMARY

Melbourne, April 17.—Our mining interest may, on the whole, be said to be prospering. Ballarat is gradually recovering from the depression she has been for some considerable time labouring under, and Sandhurst, Old Bendigo, is yielding large and regular dividends to many of her companies. The Gipps Land Gold Fields also, north and south, are turning out so rich that both miners and capitalists expect great results from this as yet little prospected district within the next year or two. At Ballarat the yield for the last quarter of 1870 was 8370 ounces in excess of the previous three months. The dividends in Bendigo last year exceeded those of any previous twelve months, having reached 237,787*l.*, against which 100,414*l.* had been called up to work the mines, leaving to the good 137,372*l.* This sum is independent altogether of the dividends paid by private companies. The approximate value of mining plant in the colony is 2,128,896*l.* Victorian gold exported this year to the 25th, 278,262 ounces, against 173,6 6 ounces in 1870.

Adelaide.—GOLD: New regulations have been issued to provide for alluvial cement and quartz mining, and also to permit of the leasing of land for gold purposes. At Barossa numbers of men are still at work, and the Government prospecting parties are engaged in their researches. The results in some cases have been tolerably favourable. The German Reef is improving with depth, and the last crushing has been very satisfactory. The greatest depth as yet attained in the German Reef is 114 feet. The total quantity of gold sold to the English, Scottish, and Australian Chartered Bank is 345 ozs. 2 dwts. 11 grs., realising 1351*l.* 7*s.* 5*d.* Of this 292 ozs. 5 dwts. 11 grs. have been obtained this year. A rich discovery of gold and bismuth is reported about 16 miles from Adelaide, on the Stony Creek, seven miles to the west of Lobethal. One reef is 12 feet wide on the surface, and another is well developed. Gold is said to be showing very thickly in the quartz. It has been mentioned that half the amount required of 10,000*l.* for commencing works on the Murry Flats has been subscribed at Ballarat, and that operations are likely to be commenced shortly. Reports are current of gold discoveries on Port Lincoln Peninsula, and of a rich find near Echunga. Arrangements have been made for letting the workings at the Stirling Reef Company's Mine on tribute. Gold has been found in the North near Mount Bryan, one man (Wm. Dare) having washed 4 ozs. of gold out of stuff adjoining a creek there in three days. Several reefs in the north-eastern district, within 40 miles of Adelaide, are still being worked, some of them with satisfactory results. The Balhannah Mining Company's last report speaks favourably of the prospects of the mine: 178 tons of cupreous bismuth ore have been shipped to England, and there is another parcel awaiting shipment.

COPPER.—There is little change at the Moonta Mine, which still maintains its reputation as being able to pour a large and regular supply of ore into the market. This is done without in the slightest degree affecting the works, which are still actively being carried on as usual, for the future development and prosperity of the mine. The yield at the Wallaroo Mines is very great, and the important additions that have been made to the staff employed, and that are in process in the machinery of the mine, attest its wealth-producing power. Tenders are being called for the erection of a new engine-house, &c., and we learn there is a probability of an immensely powerful engine being put up. At the Doora, one that may be termed a companion mine to the Wallaroo, important signs of progress are daily to be seen. It may confidently be stated that immense deposits of metal are waiting to be unearthed at this young mine—scarcely more than 12 months old. Already four great copper-bearing lodes have been cut, from two of which large supplies of rich ore are daily been sent up. The mine employs a large staff of labourers, and very soon a prosperous township will exist in its locality. That it will at an early date rival in importance the older mines we feel assured. There is evidently an improvement at the Paramatta. A greater depth has been reached, the country is found to be easier, and a drive will be at once commenced, from which increased yields may be anticipated. The fact that the Yelta has very nearly completed the erection of new and powerful steam machinery, all of which it has been able to pay for out of profits, is sufficient evidence of the richness of the property, and points to what may be expected when working on an extended and cheaper scale shall be commenced. The shareholders in the Hamley rightly value their property as one of the most promising on the Peninsula, and every day's work tends to confirm this opinion. The North Yelta has just reached the second stage in its history, and the ore will now be raised and the mine pumped by horse-power. The Poona continues promising, but little more can be said; and operations have been recommenced at the Wheal James. The Peninsula Mines alone in the world have stood the trial of the minimum price of copper without being outwardly and visibly affected. Now there seems a prospect of better times, the proprietors will, we trust, reap their reward.—*Wallaroo Times.*

COAL.—Mr. Noltenius has, for himself and others, forwarded an application to the Commissioner of Crown Lands for the reward offered for the discovery of a coal field in South Australia. The site indicated is near Hog Bay, Kangaroo Island. The regulations for working coal fields are prepared, and will shortly be gazetted.

IRON.—A quantity of iron ore has been taken into Port Victor. It was found by a well-known farmer in the Tier behind the township, and is expected to yield 90 per cent. of iron. There are said to be millions of tons equally rich, and the discoverer thinks of trying to form a company to turn the stuff to account.—*South Australian Register.*

AUSTRALIAN MINES.

YUDANAMUTANA.—The superintendent (Adelaide, Feb. 23) states with regard to the Far North Railway. The surveys have been completed, and the route fixed upon, and there is no doubt the subject will be revived next session, meantime the price we are now paying for our cartage (2*l.* 10*s.*) is so low that a railway, if in existence, could scarcely beat.—Engine and Pitwork: I have bought that at the Great Northern Mines for 500*l.*, and have contracted with an engineer to take it all down, put it up at Blinman, and start the engine, including all expenses, for 63*l.* Capt. Terrell reports under date of Feb. 20—Blinman Mine: I am pleased to inform you that we have holed to the 25 fm. level plat. In sinking we cut through several good branches of ore, it is, therefore, my intention to sollar over at this level, and begin to work upon the branches of ore mentioned in my last; at the same time I shall push on the sinking of the shaft with all speed, and have no doubt of cutting other branches of ore before we reach Hill's Lode. The branch of ore going south over the sulphurets has again gone very poor; the country throughout is very much entangled with small veins of ore, but nothing regular. The stopes between No. 3 shaft and No. 1 winze, 10 fm. level, is looking better than when last reported. Last week we cut a nice little lode of ore about 18 in. wide, it is about 2 fms. north of No. 1 winze. The stopes between Nos. 1 and 2 shafts, 10 fm. level, and those south of No. 1 winze, 25 fathom level, are looking much the same as when last reported. This week I have discharged ten men, as I can keep two furnaces going with the reduced number of hands, and have now better facilities for breaking ore away than formerly. The weather is very changeable. The ore raised and smelted 196 tons; copper made 15 tons 7 cwts.

PORT PHILLIP AND COLONIAL (Gold).—Clunes, Feb. 24: The quantity of quartz crushed during the four weeks ended Feb. 1 was 4582 tons; pyrites treated, 80 tons; total gold obtained, 1401 ozs., or an average per ton of 6 dwts. 2¾ grs. The receipts were 5256*l.*; payments ordinary, 3499*l.*; timber and firewood, 1008*l.*: total, 4507*l.* Profit, 749*l.*, added to which was last month's balance of 2011*l.*, thereby making an available balance of 2760*l.* The amount divided between the two companies was 750*l.*; the Port Phillip Company's proportion of which is 487*l.* 10*s.* The balance of 2011*l.* was carried forward to meet contracts for timber and firewood. The return for the two weeks ended Feb. 15 is as follows:—Quartz crushed, 2591 tons; pyrites treated, about 80 tons: total gold obtained, 803 ozs. 12 dwts., or an average per ton of 6 dwts. 5 grs. Remittance, 420*l.* The bulk of this is the proceeds of Collins-street property.

Telegram, dated Galle, April 17, in anticipation of the mail leaving Melbourne, March 28, and due here May 13:—"Last month, ending March 1st, yield 6 dwts.; two weeks ending March 15, 5 dwts, 2 grs. Remittance, 8*l.*"

ANGLO-AUSTRALIAN (Gold).—The directors have advices from Australia, dated, Feb 27. Mr. Kitto reports—"The engine is in good order, and works capitally; the cost of erection is much less than could be reasonably anticipated; this is in consequence of the workmen beginning to understand this kind of engine." Mr. Lamb also writes under same date:—"I beg once more to affirm my own strong belief, as also that of all the persons whom I have consulted on the subject, who have known the Anglo ground for years, and worked upon it, that the property is a most valuable mine. As I have stated before, the eastern lode is now yielding an ounce to the ton, and in our western shaft we have cut a rich leader, doubtless connected with the western lode, for which we are sinking the shaft. I will now give you an outline of the work still remaining to be done. The principal engine is fixed, and works well. The engine-house is finished, with exception of doors, windows, painting, &c. Pumps have to be placed in the two principal shafts, and these carried down another 100 ft. or so; another shaft deepened to cut the eastern lode. When the shafts are down to 300 ft., if not before, cross-cutting will soon place us on payable quartz; at least, every indication and ascertained fact tell us so. The stamping-house we need not commence until we raise sufficient quartz to test its paying qualities. There are the rods to make and fix from the engine to the two main shafts, and the winding-engine to erect after the loading is built up."

AUSTRALIAN UNITED (Gold).—The directors have advices from Australia, dated Feb. 28. Mr. Kitto writes:—"To-morrow I expect to finally arrange with the tributors at the Central Mine. I would certainly prefer our working the property on our own account. Captain Angove's letter, enclosed herewith, will give you full information as to the proceedings at this (the Central) mine during the past month." Captain Angove's report, dated Feb. 25, is as follows:—"The quantity of gold sold to the bank of New South Wales, at Malmsbury, this day, is 51 ozs. 12 dwts., the proceeds of the fortnight ending yesterday. The machine—162 trucks—washed to-day 8 tons. 9 dwts. 6 grs., making a total of 60 ozs. 1 dwt. for the fortnight, or twelve days' washing. The first fortnight in the month we washed 1158 trucks, for 24 ozs. 1 dwt. 20 grs.; the last fortnight 1761 trucks, for 60 ozs. 1 dwt.; the last week producing 40 ozs. 13 dwts. 23 grs., from 875 trucks—an average of 22¾ grains to the truck. The run of golden ground is trending towards the road that divides Elliot's from Tucker's property. The wash varies from 6 inches to 2 feet thick. In the western ground we have been stripping out the block which stood between Bessger and Prebilcock's drives. I am not in a position to say whether the run does not go out between these or not. The reef does not rise, but sand is down on it; and in consequence of this the tributors refuse to proceed any further—at least they do not refuse, but they work somewhere so that neither themselves nor anyone else can follow it, and in the end we shall be driven to the alternative of putting in a drive north-west from the long west drive to prove this. Nothing done in the eastern deep lead since I wrote you last, and the sooner we dispense with the lot of old hatters we have here the better. The water is very easy just now, and the machinery working well. I have paid the wood carters, and given each miner 40s. to-day; and we have now 81*l.* left to carry on till Wednesday." Mr. Kitto writes that "the yield of gold from the quartz at the Duke of Cornwall Mine is gradually and steady increasing." And Mr. Lamb also writes:—"I think, if we were free from debt, and had only 100*l.* to work with, that our prospects would be good at the Duke of Cornwall yet. The body of the stone we are now working is 10 feet thick, and in the small crushings we have had—13, 15, and 122 tons, and has improved thus—4, 5, and 5¾ dwts. per ton, the first of which yield would more than pay all expenses. In addition to this, if we had the means of prospecting the north and south ends of the lease we might, and most probably should, meet with better stone, as in several parts of the mine we are within a few weeks' work of lodes which have been payable in adjoining mines. In a few days Dauke's shaft will be drained again, and men put on to continue the cross-cut at the 262 ft. level. It will probably take nearly two months to reach the lode there."

ENGLISH AND AUSTRALIAN (Copper).—Port Adelaide, March 1: The quantity of coal at Port Adelaide was 1305 tons. There were three roasting, one smelting, and one refinery furnace at work at the Port Works. Since last advices 116 tons of copper had been shipped, and there were about 62½ tons awaiting shipment.

SCOTTISH AUSTRALIAN.—The directors have advices from Sydney, dated Feb. 24, with reports from Lambton Colliery, to the 21st. The sales of coal for the month of January amounted to 9590 tons. The coal trade is reported as being rather slack owing, to some extent, to a scarcity of shipping for foreign ports, from which there were orders for a good deal of coal.

YORKE PENINSULA.—The directors have advices from Adelaide stating that the engine at the Kurilla Mine had been started on Feb. 25, and that by March 1 the water had been drained down 6 fathoms below the 15.

FOREIGN MINES.

DON PEDRO NORTH DEL REY.—Telegram from Lisbon: Produce for February, 7778 oitavas; weighed to March 18, 1718 oitavas.

ECLIPSE (Gold).—The directors have received a report, dated March 25, from Mr. Henry Tregellas, of which the following is an extract:—Haymen's shaft is down 66 ft. below the 220. The lode is 8 ft. wide, and has so improved in value the last 30 ft. that it is now the richest part we have in the mine. The gold is larger and in greater quantity than I have heretofore seen in any part of the mine, showing gold freely, and by "panning" I am confident in saying it will pay well. This speaks well indeed, for a large, continuous, and a good mine in depth.

BATTLE MOUNTAIN.—Capt. Richards, March 30: Virgin: In the 113 ft. level, west of Hallow's shaft, driving on a cross-course, we have, I think, the lode, but so little has been done on it I cannot yet say what it will do. It is, however, so far producing some rich black oxide of copper; this is the more important, as it is the deepest point in the mine. I hope by next week to be able to see more of it, and will then report as fully as I can; if it proves to be the lode it is on the side of the cross-course I expected, and where I told the men to keep a sharp look out for it. The lode in the 73 ft. level, north of Hollow's shaft, continues of large size, 3 to 4 ft. wide, composed of gossany ledge matter, green carbonate and red oxide of copper, in very small quantities, but it promises to improve daily; this level should be pushed on, it is an important point. In the stopes in back of the 113 ft. level, at Roach's winze, I cannot yet see what effect the lode will have on the cross-course, or *vice versa*—there seems to be a struggle for the mastery, which can only be decided as we proceed. As soon as any clear and definite result is ascertained you shall be advised. We have not yet resumed the sinking of Moore's winze, for want of men. Jack's stope, in back of the 73 ft. level, north of Roach's winze, produces some good ore, but of lower quality than heretofore, but which in England would be considered good enough. I find a great many changes in a very short space of ground, and pehaps in no mine in the world is there greater varieties of copper ore, and (considering the quantity) a richer average quality than here.—Lake Superior: Moore's rise, in the 70, south of Pryce's shaft, has been holed to the surface, thereby increasing the ventilation both for sinking the shaft (Pryce's) and for driving the level towards the junction of this with the Virgin lode, and which I consider a most important point. The men who were rising have resumed sinking Pryce's shaft, which is now down about 17 ft. below the 70 ft. level; the lode is a mixture of blende, mundic, spar, quartz, peach, prian, and a small quantity of black oxide of copper ore, of no value here, but would be considered very promising in England. Owing to the large scale upon which one of the mines in this neighbourhood is about to be opened out, absorbing all the men, I cannot push on some points I wish. I expect this, however, will right itself in a short time. Ore waiting shipment, 1334 sacks; ditto at mine and station, 974 sacks.

BRAGANZA (Gold).—Capt. Roberts, March 16: As I have informed you, we are now working the mine more for future than present results, in order to lay open the same on a larger scale, and to facilitate the working on the different lodes. We have completed 59 fms. of tramroad, intersected the three lodes, and are tramming over the same. By our mode of working it is astonishing how cheaply everything can be thrown down and brought on to the stamps (15 heads) by the adit—no shaft sinking or pumping, no horse-power, no ladders, no wear and tear of chains, &c. From the deep adit to the ancient workings is 600 ft. high on the course of the lodes. Allowing for all the expensive dead work done, water brought home, houses built, roads made, a new 9-head stamps almost ready to work, and 220 tons of quartz ready for stamping, and the small expense that for the future will be incurred, I see no mine that is deserving more attention than this is at present. We have on hand about 333 ozs. of gold.—[Mr. Richards left England for the mine on March 9, quite restored to health.]

PESTARENA UNITED.—Thomas Roberts, James Mitchell, April 15: Pestarena Mine: No change of importance has taken place in the past week. The 55 end, driving north of Aquavite engine-shaft, yields 8 tons of ore per fm., worth 10 dwts. of gold per ton, and end south 3 tons, at 15 dwts. The 46 end driving south 3 tons, worth 15 dwts. per ton. This end north from stope, in bottom of the 23, yields 5 tons per fathom, worth 18 dwts. per ton.—Pescutera Mine: The end driving north in the 33, on No. 2 lode, yields 4 tons per fathom, worth 12 dwts. per ton. The north incline shaft, sinking below the 80, yields 8 tons per fathom, worth 1 oz. per ton.—Val Toppa Mine: The end driving north above No. 2 level, on the western part of the quartz lode, has somewhat improved, producing 9 tons per fathom, worth 15 dwts. of gold per ton. The end south has slightly decreased in value, producing at present 6 tons per fathom, worth 10 dwts. per ton. We have resumed sinking the winze in bottom of No. 2 level, north of third cross-cut, on the new lode, producing 12 tons per fathom (for length of winze), worth 12 dwts. per ton. There is no change in other points not mentioned. We melted to-day on account of the present month, and consigned to Signor Carlo Menozzi, three ingots of gold, two from Val Toppa district, weighing 5430 grammes, equal to 174 ozs. 13 dwts. 3 grs., and one from Pestarena, 1673 grammes, or 53 ozs. 16 dwts. 7 grs.: the total consigned being 7103 grammes, equal 228 ozs. 9 dwts. 10 grs., obtained from 320½ tons of ore.

[For remainder of Foreign Mines see to-day's Journal.]

FLEXIBLE SHAFT.—The invention of Mr. J. B. MORRISON, of St. Louis, consists, first, in a flexible shaft by which motion is conveyed from a stationary rotating shaft or head to a drill burr or other tool, enabling the tool to be applied to any object within its range. Second, of a sleeve enveloping a portion of the flexible shaft, and extending a greater or less distance toward the fixed end of the shaft, the sleeve giving journal bearing to the enclosed part of the shaft, and in most cases to the tool. Third, in an adjustable head or socket, which gives journal bearing to a tool, the head being connected by a universal or a common hinge to a sleeve which envelopes the extremity of the sleeve before mentioned, and admits of turning thereupon, so that the tool can be adjusted to any desired angle with the sleeve, and the latter may be freely turned when in use. Fourth, in combining with the flexible shaft a parallel bracket which admits of swinging to the right or left, of vertical adjustment, or of extension or contraction, a tray for operating tools being supported upon the bracket, and maintaining its horizontal position during all these movements.

Meetings of Mining Companies.

ANGLO-ARGENTINE COMPANY.

A general meeting of shareholders will be held at the London Tavern, on Thursday, Bishopsgate, when the following directors' report will be presented:—

The directors have the pleasure to submit their third report to the shareholders, together with statement of accounts, made up to the end of December last. The accompanying report of the manager enters fully into the operations of the company for the past year, and shows that considerable progress in the development of the company's property has been made, more particularly in the mining department. The directors much regret the delay that has occurred in the erection of the engine and stamps. The delay has been occasioned by the difficulties experienced in the inland carriage of the heavy portions of the machinery. The directors referred in their last report to these difficulties, and hoped they had been overcome by the construction of the road between San Juan and the mines, but the carriers being unused to the carriage of such very heavy materials, similar difficulties have also been experienced between Rosario and San Juan. Capt. Vivian, however, expects to have the engine at work in March (last month), soon after which returns may be looked for—returns which your board confidently anticipate will not only surpass their most sanguine expectations, but be lasting and permanent. Great delay also occurred in the shipment of the reduction machinery, ordered by the company's late manager in Germany last spring, in consequence of the war on the Continent. Mr. Pearson Morrison having retired from the management in the Argentine Republic, Capt. Joseph Vivian, who has been at Guallian from the commencement of the company's operations, has been appointed his successor. The directors feel confident that no effort will be wanting on the part of that gentleman to bring the mines into full and profitable working. In his report he says:—"I congratulate you on the success awaiting you at these mines, and I hope for the meeting of 1872 I may have more material matter to report on." The delay that has taken place will render it requisite that further capital should be provided, and for this purpose a resolution will be submitted to the proprietors, authorising the directors to issue 20,000*l.* (or a smaller amount) of debentures, bearing interest not exceeding 10 per cent. per annum, and repayable in five equal instalments out of profits in three, four, five, six, and seven years (which the directors feel confident they will be able to do out of the profits of the company), each holder of debentures to be entitled to receive in respect of every 10*l.* paid off a 1*l.* fully paid-up share as bonus, in addition to his capital and interest. The accounts herewith presented have been audited by Messrs. J. Waddell and Co., whose report will be found annexed.

Mr. Joseph Vivian (the manager), in his report, says:—Altogether the summary of work done for the year may be considered highly satisfactory, considering the uncertain attendance of labour and other local difficulties. A contract has been made for the entire provisioning of the mines, the company prior to this undertaking same. Immense benefit will be derived from this, the loss of time, combined with waste, being somewhat considerable. The same contractor also undertakes the supply of wood. First contract, 2500 tons, at $9 per cayon—some 200 tons already delivered.—Number of hands employed: English, 23; natives, average for the year, 104: total, 127.

Mr. Graham Stuart, F.G.S. (the reduction officer), in his report, says:—A series of assays of samples from various parts of the mine were undertaken in September and October last by Mr. Telthe, professor of chemistry, &c., in the college of San Juan; the results of these are, I belive, already in your hands.

NORTHERN SILVER-LEAD AND BLENDE MINING CO.

At the second ordinary general meeting of shareholders, held at the company's office, Abchurch Chambers, London, on April 14,

Mr. JAMES SPITTALL in the chair,

The reports of the directors and manager and the accounts, showing a balance of 1557*l.* 11s. 4d. cash in hand (which, with the manager's report, had been previously distributed to the shareholders), having been read and examined, were received and adopted.

Mr. William Nutt Field was re-elected auditor, his remuneration to be five guineas for each audit.

Capt. R. ROWE, the manager, in his report, says—"The new 24-in. engine is being made by the Sandycroft Foundry Company, and the greater part of the stone necessary for the buildings is quarried. As stated in my report of Dec. 24, I have since the commencement had erected an office, storehouse, a joiner's and smith's shop. Seeing, therefore, that we are over the winter, and have the full summer before us, I hope to make rapid progress in the great and chief object of the mine, as first and always represented, that of getting into depth below sea level, and then to drive out north towards the elvan course, at and about which it is anticipated the lodes will form a junction, with a result upon which only one opinion has been expressed by all competent parties who have examined the mine—that of all but certain success. To this point I shall direct all our energies with the least possible delay."

WHEAL GRAMBLER MINING COMPANY.

The first general meeting of shareholders was held at Tabb's Hotel, Redruth, on Wednesday, April 12,

Mr. WM. PAGE CARDOZO in the chair.

The CHAIRMAN read the notice convening the meeting, and said that gentlemen present all fully understood that the object of the meeting was to establish the Wheal Grambler Mining Company, to appoint purser and agents, and to make a call for the working of the mine. He should read to them reports of the mine, in which he fully concurred, which would show them that they had a very fair prospect before them. The promoters proved the confidence they had in the concern by working it on their own responsibility for some months, satisfied that their friends would when the matter was brought fully before them support them in their undertaking, especially as they had come forward on the good old Cornish principle of not asking any premium. In this they had been successful; he had been asked to join only a few days ago, and he readily accepted the invitation, and was highly gratified in seeing such a number of gentlemen of influence and mining experience around him prepared to carry out the objects of the meeting.

The following reports were then read to the meeting:—

This mine lies immediately east of Pedn-an-drea United Mines on the same lodes, and immediately north of old Grambler on parallel lodes. Grambler lode, as is well known, has been extensively worked, and has been very productive of great riches, both of copper and tin. There are four other lodes passing through this sett, which, excepting the workings of the ancients above the water level along the backs, are almost entirely unworked through the length of the sett, 300 fathoms. These lodes are worked in Pedn-an-drea United, and are very productive there. They are also cut in St. Aubyn United shallow levels, where they are large promising lodes, containing tin-gossan of a most beautiful description. In Wheal Gramber these lodes have been wrought by the ancients for a few fathoms deep only. And judging from the extensive character of these surface workings, and the quantity of tin left in the burrows from them, they must have been very rich, and, no doubt, will be found very productive as soon as you sink below the old men's water level, which is some 13 fms. from surface.—JOHN MITCHELL.

Redruth, April 12.—This mine is situate in the north flank of the Carn Marth granite range, having St. Aubyn United Mines adjoining on the east, and Pedn-an-drea United Mines on the west, with the principal lodes of both these mines running through the sett. Thus there are several known lodes north of the well-known productive lode of Old Grambler, and on the same parallel, neither of these lodes having been wrought in the sett, although they are highly productive in both the adjoining mines. Two of these lodes, which have been already partially opened by the deep adit cross-cut, produce tin in paying quantities. Three remain to be cross cut, which can be accomplished very expeditiously in the deep adit level, some 40 fms. below the surface. Looking at the surface indications of the extensive old men's workings along the backs, which not only point out broad and continuous shallow excavations, but seem also plainly to indicate that one of these is Pedn-an-drea great north lode, I do not think that anyone will dispute either the importance of this cross-cut or the prospect of a very successful result. I would recommend the shaft now in course of being cleared to be completed to the adit level as rapidly as possible; as soon as this is done you will be enabled to set several tin pitches on tribute in the back of the adit, on the lodes already partially opened, and to push away the cross-cut to the north lodes. Meanwhile, I would open a shaft near St. Day road, on the old men's workings, and sink on the course of the lode as deep as the water will permit; by this course you will be proving the lode and getting the shaft ready, in anticipation of the cross-cut, and, probably, during the summer months may be enabled to open tin ground on that lode also, even before the cross-cut can reach it. From the quantity of tin already discovered, from the position of the mine, the indications, and general evidence of the important lodes mentioned being all contained in this sett, I fully believe that a proper development of this ground above the adit will supply the means of proving it below, and that there is every prospect of cheaply and expeditiously opening up a great and profitable mine.—W. TREGAY.

The following resolutions were then agreed to:—

It was proposed by Mr. F. W. DABB, seconded by Mr. JOHN THOMAS, and carried unanimously:—That this mine be divided into 512 parts or shares, and to be worked on the Cost-book System and under the Stannaries Act of 1869.

Proposed by Mr. WILLIAM TREGAY, seconded by Mr. J. H. REYNOLDS, and carried unanimously:—That Messrs. Tweedy, Williams, and Co., Cornish Bank, Redruth, be the bankers of the company.

Proposed by Mr. JOHN HOCKING, jun., seconded by Mr. JAMES EVANS, and carried unanimously:—That the working of the mine be proceeded with forthwith in accordance with the report presented, which is hereby adopted, and that the costs already incurred in working the mine (122*l.* 0s. 3d.), as presented, be accepted and passed into the accounts.

Proposed by Mr. RICHARD S. HICHENS, seconded by Mr. JOHN HOCKING, jun., and carried unanimously:—That Mr. W. Page Cardozo be appointed the purser of the mine, that Capt. William Tregay be appointed manager, and that Capt. John Tregay be appointed the resident agent.

Proposed by Mr. W. PAGE CARDOZO, seconded by Mr. F. W. DABB, and carried unanimously:—That Messrs. John Hocking and Son be the engineers of the mine, and that Messrs. Hichens and Richards be the surgeons.

Proposed by Mr. F. W. DABB, seconded by Mr. RICHARD S. HICHENS, and carried unanimously:—That a call of 10s. per 512th share be now made, payable forthwith either to the purser or to the bankers of the company.

Proposed by Mr. JOHN THOMAS, seconded by Mr. F. W. DABB, and carried unanimously:—That for the services Messrs. Borlase, Tregay, and Thomas have rendered this company they be remunerated to the extent of 50*l.*

Proposed by Mr. JOHN THOMAS, seconded by Mr. WILLIAM TREGAY, and carried unanimously:—That the general meetings be held quarterly, and that the next meeting be on July 12 next, of which due notice shall be given.

The cost-book was signed by shareholders representing 392 shares out of 512, the remaining number all being taken and acknowledged by letters produced at the meeting.

A vote of thanks to the Chairman terminated the proceedings.

FLORIDA SILVER-LEAD MINING COMPANY.

The second general meeting of shareholders was held at the London Tavern, Bishopsgate-street, on Wednesday,

Mr. H. W. LINDOW in the chair.

Mr. HODGSON, jun., read the notice convening the meeting.

The report of the directors congratulated the shareholders on the progress made. There have been 247 fms. of levels cleared, and rails laid down. The engine-shaft has been cleared, timbered, &c., to 32 fms.—that is, 10 fathoms below adit. An 18-ft. water-wheel has been erected; pit, bob-pits, flat-rods, &c., have been substantially completed; dressing-floors have been laid out, and fitted with a 20-ft. and 12-ft. water-wheel, two crushers, jiggers, picking-tables, and all other requisites. There is now on the mine a substantially built office, carpenters' shop, smithy, and ore house. About 5000 yards of water-course have been cleared, and an 8-ft. embankment made at the outlet of the Teivy Pool, to ensure a constant supply of water; slime pits, water-course from the mine, and many other necessary works have been complete; there is also a good stock of rails, timber, powder, and other stores. On Tuesday, the 11th inst., 20 tons of lead were sampled. An account of the lead and blende raised and sold is annexed. The directors are assured that the mine is now in a position to warrant them in hoping henceforth to make profitable returns.

The CHAIRMAN said that he did not know he could add much to the information contained in the report. The amount of work done was plainly indicated, as also the amount of expenditure incurred, and the amount of lead and blende that had been sold. Credit had been taken for 100*l.*, for 50 tons of blende, but there will be a larger amount to the credit of the company, inasmuch as the amount actually sold was 59 instead of 50 tons. Besides this 15 tons had since been sold, as well as 20 tons of lead, and all that had been estimated was the lead at the dressing-floors. The accounts showed that on March 31 the assets amounted to 1374*l.* or 1400*l.*, and costs incurred since had been more than met by the returns. When on the mine last week the manager assured him that after this month he did not expect to have to ask the directors for any more money to meet the costs, inasmuch as he fully believed the mine would henceforth be more than self-supporting. At some future time it might be desirable to incur some outlay at the easternmost portion of the sett, where many old shallow Roman workings were traceable. Investigation had discovered that in an old shaft—known as Percy's—there had been left about 10 fms. of ore ground. As far as could be at present determined this was a totally distinct lode from that being wrought in the western ground. The specimens on the table he broke from that lode himself, and the agent calculated that it would yield about 1½ to 2 tons of lead per fathom, and thought it probable it would be reached at about 8 fms. north of the present deep adit level. If their calculations should prove correct there was 30 fms. of lode, which could be reached by means of a cross-cut from the deep adit. It might be advisable at a future time to raise some additional capital to thoroughly develope this encouraging portion of their mine. He moved that the report and balance-sheet be received and adopted.

Mr. W. GUNDRY seconded the proposition, and mentioned that the matter referred to by the Chairman with regard to the eastern ground was a matter only for future consideration.

Mr. G. SNOW asked what the profitable returns were likely to amount to?

The CHAIRMAN said he could only answer that question by stating that the returns would not only meet the costs, but leave sufficient profits to pay dividends.

Mr. H. E. TAYLOR, in reply to a question, stated that the average of the stoping ranged from 30s. to 50s. per fathom.

Mr. W. GUNDRY mentioned that the mine was now provided with plant and machinery second to none in any young mine in Cornwall.

The motion adopting the report and balance-sheet was then put and carried unanimously.

Messrs. H. W. Lindow and W. N. Rudge were re-elected directors, and Mr. W. F. Smart was re-appointed auditor.

A vote of thanks was passed to the Chairman and directors, which terminated the proceedings.

ESGAIR LLE SILVER-LEAD MINING COMPANY.

The second general meeting of shareholders was held at the London Tavern on Wednesday—Mr. H. W. LINDOW in the chair.

Mr. HODGSON, jun., read the notice convening the meeting.

The report of the directors congratulated the shareholders on the highly satisfactory development which has taken place at this mine. It has been found necessary to erect a new water-wheel for pumping purposes now that a greater depth has been attained, so as to allow the power of the former wheel to be applied to drawing and dressing purposes. When this wheel is completed, and the dressing-floors somewhat enlarged, the directors hope to be able to make regular and profitable returns. There being no accommodation of any sort for miners within a reasonable distance of the mine, the directors think it will be advisable either to build cottages or to convert certain farm buildings into cottages for their accommodation; they might then hope to obtain labour on cheaper terms than at present. It will be necessary to provide funds for the above purposes by the issue of the 340 shares at present unallotted, and the directors are prepared to receive tenders at par for the same, and to give preference to present shareholders in any allotment they may make.

The report of the manager (Capt. John Williams) stated that the mine is opening out well, and the prospects were never better than at the present day. They will sample again on 25th April 25 tons of good quality ore. They find it impossible to procure sufficient hands to dress the ore; the scarcity of lodgings for the people is the greatest obstacle.

The CHAIRMAN moved that the report of the directors and balance-sheet be received and adopted, and stated that Mr. H. E. Taylor, who had the principal management of the mine, was present to afford the shareholders any information beyond that contained in the report.——Mr. W. N. RUDGE seconded the proposition.

Mr. H. E. TAYLOR explained by means of a section the chief points of operation, and stated that when this company purchased the mine it had one of the finest lodes he had ever seen in any mine in Cardiganshire, and he had seen every mine in that county. There was a very fine lode in both ends, and a large quantity of stoping ground laid open, none of which had yet been removed, and this ore ground had not yet been reached in the next deepest point of operation. As soon as the water-wheel was finished, which at the latest he hoped it would be next week, the sinking of the shaft would be resumed, and so reach another level. They could raise fully 20 tons of ore per month from this part of the mine alone, and he had every reason to hope that the returns would soon be increased, and satisfactory profits realised. There was no doubt whatever that when the mine was fairly opened it would be a very good property.

The CHAIRMAN directed attention to the paragraph in the directors' report referring to the advisability, if not the absolute necessity, of providing house accommodation for the miners, and stated that of the unissued shares 20 had been taken since the report was issued, leaving 320 to be subscribed for, which the directors, already holding more than 1500 shares each, were quite willing to take among themselves, but it was thought fair to offer them in the first place to the shareholders.

Mr. H. E. TAYLOR pointed out the great advantage that the mine would realise by house accommodation being provided for the men on the spot, and mentioned that there were some farm buildings in the neighbourhood which could be converted into cottages at a small cost. There was no doubt that the enlargement of the dressing-floors, and the providing of house accommodation were quite essential to the working of the mine upon a large scale. By the remodelling of those old farm buildings accommodation could be afforded to 70 or 80 people. The capital provided by the at present unissued shares would be sufficient to place the mine in a very good position. The mine was looking wonderfully well. The fine stones of ore on the table came from the 34 fm. level west, and from the rise in the 22 fm. level.

The CHAIRMAN mentioned that the great feature in the mine was that the several bunches of ore increased in length and width in depth.

The motion adopting the report and the balance-sheet was put and carried.

Messrs. H. W. Lindow and W. N. Rudge were re-elected directors, and Mr. W. F. Smart was re-appointed auditor.

A vote of thanks to the Chairman and directors terminated the proceedings.

GREAT CARADON MINING COMPANY.

A general meeting of shareholders was held at the offices, Gresham-buildings, Basinghall-street, on Tuesday,

Mr. NICHOLLS in the chair.

Mr. GRANVILLE SHARP (the secretary) read the notice convening the meeting, and the minutes of the last were confirmed.

A statement of accounts was submitted, made up to the end of February, which showed a credit balance of 236*l.* 4s. 2d.

The report of the agent was read, as follows:—

April 15.—Since the last four-monthly meeting of shareholders our operations have been confined to sinking the engine-shaft. Our object, as you are aware, is to reach the 90. It is at this point we expect the caunter lode of the Caradon Mines to form a junction with the south lode, and from which we have every reason to expect great results; we have about 3 fms. more to sink the shaft to reach this point. I am sorry to say the hard floor of ground we have had in the shaft still continues. At the time of the last meeting we thought we should soon be through it; there was a change for the better, but it has not gone out as I had hoped. We have a quantity of quartz just come across the shaft, which I am glad to see, although it is just as hard it is a change from the elvan, and I hope will lead to a clean channel of soft ground; a little improvement in the ground would soon enable us to make the required depth (90 fathoms). The prospects we have before held out for opening a productive mine at this deeper level are not in the least abated. The strong lode we have at the 70 producing rocks of copper and blende wonderfully improved from the level above cannot fail, I think, of itself when cut 20 fms. deeper, in addition to which there will be the junction of the two lodes, always a point to look for deposits of ore. The continued hardness of the ground in the shaft has been, and still is, making the progress slow and tedious, but these are circumstances over which we have no control. We are pushing everything as fast as possible. I hope the shareholders after laying out so much money will have a little more patience to reach what we have every reason to hope and expect will be the turning point in the future of the mine. The pitwork and machinery are all in good order, and working well.—WM. TAYLOR.

Capt. TAYLOR said that he expected every foot they sunk they would get into easier ground. If the ground continued of the same character it would take them about four months to reach the lode.

Mr. THOMAS asked if this hard bar of ground was a favourable indication?

Capt. TAYLOR said similar hard floors were occasionally met with in Marke Valley and East Caradon. Had they known this hard floor was there they would have sunk on the course of the lode.

The SECRETARY mentioned that the improvement in the character of the lode between the 60 and 70 was very marked.

Capt. TAYLOR said that in about eight or nine months they would, probably, reach the junction.

The report was received, and with the accounts were ordered to be entered on the minutes.——A call of 2s. per share was made.

A special resolution was passed forfeiting all shares in arrear of calls, but subject to restoration if the same be paid within 21 days.

A vote of thanks to the Chairman terminated the proceedings.

WHEAL IDA MINING COMPANY.

A general meeting of shareholders was held at the offices, Gresham-buildings, Basinghall-street, on Tuesday,—Mr. JONES in the chair.

The notice convening the meeting having been read, the minutes of the last were confirmed. A statement of accounts was submitted, made up to the end of February, which showed a credit balance of 163*l.* 3s. 9d. The report of the agent was read, as follows:—

April 15.—Soon after the last meeting of shareholders we cut the new lead lode in the 40 fm. level cross-cut east, referred to in my last, and have driven south on its course about 7 or 8 fms.; it is from 6 to 12 in. wide, principally quartz, with spots of lead and mundic; the ground about it is favourable, but so far it has not turned out as we were led to expect from the appearances when cut at the surface. We have opened but a short distance yet to make much trial. We are pushing on further south on the course of this lode, with the hope that it will soon improve. I would recommend this to be continued for some two or three months at least, to see if the lode will open or improve. There is a good deal of water coming out of the end, which is favourable. We have an east and west lode standing to the south, which we opened on at the surface, showing a kindly back, which should be proved either by driving on the lead lode south to it, or by small trial shaft from surface. Should the lead lode not improve in the next three or four months I should then advise a trial shaft on the east and west lode.—W. TAYLOR.

Capt. TAYLOR said that inasmuch as a little more water was coming out of the end a favourable change might take place in a short time. He wished it to be distinctly understood he would not continue any exploratory operations that did not present chances of discovery.

The report was received, and with the accounts were ordered to be entered on the minutes. A call of 1s. per share was made.

A resolution was passed forfeiting shares in arrears of call, but subject to restoration if the call be paid within 31 days.

A vote of thanks to the Chairman terminated the proceedings.

At West Wheal Frances meeting, on April 13, the accounts for three months ending January showed a credit balance of 697*l.* 6s. 7d. The profit on the three months' working was 571*l.* 6s. 9d. A dividend of 512*l.* (1*l.* per share) was declared, and 185*l.* 6s. 7d. carried to credit of next account. Capts. Thomas, Craze, and Rabling reported that the discovery of the tin ground in the 95 and 132, east of Bailey's shaft, has much improved the prospects of the mine.

At Cook's Kitchen Mine meeting, on April 13, the accounts for the three months ending January showed a credit balance of 2385*l.* 7s. 2d. The profit on the three months' working was 1835*l.* 9s. 5d. A dividend of 1531*l.* 5s. (12s. 6d. per share) was declared, and 304*l.* 2s. 2d. carried to credit of next account. Capts. J. and C. Thomas and F. Gilbert reported upon the various points of operation.

At South Carn Brea Mine meeting, on April 14, the accounts for the three months ending February showed a debit balance of 1158*l.* 10s. 4d. A call of 2s. 6d. per share was made. Captains Rich and Knotwell reported upon the various points of operation.

At East Gunnislake and South Bedford Mines meeting, on Monday Mr. C. F. Carne in the chair), the accounts showed a balance of 425*l.* 1s. 2d. to be provided for. A call of 2s. 6d. per share was made. Capt. James Bray reported that from the present appearance of the lode in the bottom of the mine, going west towards the cross-course that made the ore in Devon Great Consols and other mines, he believes they will not have to drive far before they meet with good results.

At the New Victoria (South Devon) Mining Company meeting, on April 13, the balance-sheet to Dec 31 showed a credit balance of 716*l.* 12s. 1d. The cross-cut in the 96 will cut the south lode 30 fms. below where it has yet been seen, and as its appearance in the 66 is very kindly they are sanguine that they will cut the lode rich, and in abundance. Capt. W. Skewis reported that they had recently erected at the mine a patent jigging apparatus, and having enlarged the pond and repaired the large water-wheel, they have crushed and jigged some of the ore that has been raised from their drivings. The engine and boilers, and pitwork, are all in first-rate working order. The lodes are occasionally producing good stones of mundic, and Capt. Skewis is not aware of lodes producing such quantities of mundic falling to produce large quantities of copper.

At Wheal Jane (Kea) Mine meeting, on Monday, the accounts for the four months ending December showed a debit balance of 342*l.* 1s. 4d. The loss on the four months' working (including 503*l.* for new machinery) was 1006*l.* 0s. 9d. Capts. W. Giles, W. Giles, jun., and Thos. Williams report that the heavy additional cost which they have incurred during the last six or eight months in the erection of a new calciner, engine, pulveriser, dressing-floors, &c., must of necessity reduce their cash balance, but these erections having been absolutely necessary, will in time pay for themselves, and be remunerative to the adventurers. The extra bills being now almost all charged, they hope soon to resume their former position, and pay their usual dividend. All the machinery on the mine is working satisfactorily. The committee recommend bringing forward another month's cost. Mr. J. P. Bennetts, the auditor, states that this would increase the debit balance to about 1500*l.* The heavy bankers' charges which appear in the accounts have been incurred by paying dividends before there was cash at the bankers' available for the purpose.

At East Caradon Mine meeting, on Wednesday (Mr. R. W. Childs in the chair), the accounts for the three months ending February showed a credit balance of 3197*l.* 14s. 6d. Capt. John Truscott reported that as the lodes get further developed in the northern part of the mine, and from the favourable changes of strata in the 115 cross-cut south, he considers their future chances of success are of an encouraging character.

At Carn Camborne Mine meeting, on Wednesday (Mr. A. H. Cockett in the chair) the accounts for the three months to date showed a debit balance of 595*l.* 13s. 8d. A call of 1s. per share was made. Capt. Henry Bennett reported upon the various points of operation, and asserted, with confidence, that they have a valuable mine, and that the 40 and 50 fm. levels have greatly added to the reserves.

At Great South Tolgus Mine meeting, on Tuesday (Mr. J. Darbyshire in the chair), it was resolved that the further prosecution of the mine be abandoned; that the mine be offered for sale as a going concern; and that, in the event of no sale being effected, the machinery and materials and the remaining property of the shareholders be sold and realised forthwith; and that the affairs of the company be wound-up at the earliest practicable period, Messrs. Darbyshire, Buckley, and Laws, were empowered to take necessary steps.

At the Arivaca Mining Company meeting, on Wednesday, the following modificaitons in the contract with the vendors was approved:—That the obligation of giving 100,000*l.* in mortgage debentures is cancelled, and that the territory will be acquired by the company free from all obligation, the vendors receiving for the absolute transfer of the property 7500 fully fully paid-up shares, and 10,000*l.* in cash. The directors to take the necessary steps for obtaining ratification by the vendors, if in their judgment sufficient capital is subscribed, and that the meeting be adjourned until a day to be fixed by the directors for that purpose.

At the Peak Downs Copper Mining Company sixteenth half-yearly meeting, held on Jan. 30, at the offices, Bridge-street, Sydney (N.S.W.), the directors had the pleasure of reporting more favourably on the affairs of the company than when they last met the shareholders. The mine continues to produce large quantities of ore of the usual average—6441 tons having been raised during the past half-year at a reduced cost. The old furnaces have been repaired, some entirely rebuilt, new ones constructed, and others are now in course of erection. The average production of refined copper has already reached 42 tons per week, and it is hoped that in a few months a larger quantity may be smelted. The accounts showed that 51,323*l.* 12s. 8d. had been received during the half-year on account of copper shipped or sold, and 218*l.* 5s. 8d. from rents and other sources, while the copper unsold on hand and ore at grass on Dec. 31 are estimated at 42,729*l.* 11s. 6d. On that date the balance at the credit of profit and loss account was 14,746*l.* 8s. 9d., which enabled the directors to declare a dividend at the rate of 10 per cent. per annum.

[For remainder of Meetings see to-day's Journal.]

CLEANSING STEAM-BOILERS.—Mr. J. W. BROADBENT, Oldham, fixes to the interior of the boiler one or more hollow bearings, according to the number of scummers required, each bearing having a pipe opening to the exterior of the boiler, and to this pipe is bolted another pipe connected to a valve box having an outlet valve. Each hollow bearing carries a lever having at one end a counterbalance weight, and at the other end a float and scummer, and from this end to the bearing the lever is formed as a tube or pipe. The float is made of baked clay, brick, or other indestructible material, and to it is fastened the scummer, in which there is a hole or mouth-piece leading to the tubular part of the lever and exterior pipe, there being between the float and the scummer a space for the scum to pass to the mouthpiece.

SMOKE PREVENTING.—The invention of Mr. O. GJERDRUM, Christiania, consists in a peculiar arrangement of fire-doors and dampers in boilers, having more than one furnace, the fire-doors and dampers being in connection with each other in such a way that when, for instance, in a double-flued boiler the right-hand door is opened for the purpose of firing, a damper on the same side shuts the flue corresponding, thus compelling the products of combustion from the right-hand furnace to pass over and mix with the products of combustion passing off by the left-hand flue, the damper for which is simultaneously opened. On shutting the right-hand door the dampers remain in the same position till the effect of the raw coal put on has disappeared. The left-hand fire-door is then opened, by which the position of the damper becomes reversed.

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